DISTRO

091313 #107

engadget

NOKIA'S LARGEST LUMIA TO DATE

LG'S FINGER-FRIENDLY G2

PLUS: Q&A WITH ANDROID CENTRAL'S PHIL NICKINSON

GAMING THE SYSTEM

HOW **EDWARD THORP** GAMBLED HIS WAY INTO WEARABLE-TECH HISTORY

ISSUE 107

ENTER

FORUM

REVIEWS

FEATURES

ESC

On the Cover:
Photograph by Sam Comen for Distro

THE SECRET IS OUT

DISTRO
09.13.13

EDITOR'S LETTER

This week's Distro includes our first hands-on looks at Apple's new iPhones, the 5c and 5s. And you should read them — and check out our hands-on videos. But I'm not going to be spoiling anything by saying that we didn't find anything about the new phones very surprising. After months of speculation, leaks and rumors, Apple's iPhone event this Tuesday was something of a letdown. From the "champagne" iPhone 5s, to the phone's fingerprint reader, to the "budget" 5c series, virtually everything that was announced on Tuesday was public knowledge — or at least well-circulated on the rumor mill — well in advance. Unlike earlier Apple announcements, there was no "one more thing" lurking under the covers. The launch of the iPhone 5c and 5s was a by-the-numbers Apple event that could have been assembled from an Apple launch kit. Tight guest list and carefully orchestrated media buzz? Check. Black-shirted CEO? Check. Brief performance by an aging pop star? Check. Excitement and surprises? Sorry, not this time.

Part of this, of course, isn't Apple's fault. The iPhone is now a mature product, and its updates are inevitably going to be more incremental improvements than revolutionary changes. And without any surprises, like an iPad refresh or smartwatch, it was inevitable that Tuesday's launch event would seem a bit anticlimactic. But there's no question that Apple's once-vaunted ability to keep a tight lid on rumors and leaks has taken a hit in the Tim Cook era, which means that even features that might have caused some excitement on Tuesday, like the 5s' fingerprint reader, seemed like old news. For any other company, that might not seem like a big deal; most of the features of Samsung's recently announced Galaxy Note 3 were well-known prior to last week's press conference, and we don't expect any surprises when the Nokia 1520 eventually becomes official. But Apple has long positioned itself as a different kind of company, and Tuesday's event left a lot of people longing for a bit of that Steve Jobs magic — or at least one insanely great feature we didn't already take for granted.

While Apple didn't tease the long-rumored iWatch, other companies, from Samsung to Google to Fitbit, con-

EDITOR'S LETTER

"Black-shirted CEO? Check. Brief performance by an aging pop star? Check. Excitement and surprises? Sorry, not this time."

One of the five colorful plastic iPhone 5c models.

tinue to push wearable technology in new directions. In this week's Distro, we take a long look back at Edward Thorp, a pioneer of wearable tech, whose first devices were cumbersome computers designed to give gamblers an edge in games like roulette. Thorp's 1961 roulette computer worked well enough that such gadgets are now routinely banned from casinos, and Thorp himself moved from building devices to give gamblers an edge to applying the tools of statistical analysis to the stock market. "When you're betting millions," he says, "betting hundreds of thousands doesn't seem meaningful." It's hard to argue with that logic, or with Thorp's modest assertion that he "was just interested in solving a problem and seeing if I could do it. The fact that it was a wearable computer was just part of solving the problem." That's the kind of thinking that leads to insanely great innovations, and it's as true now as it was 50 years ago. D

MARC PERTON
EXECUTIVE EDITOR, ENGADGET

2DS KUDOS, NERD CHEFS AND THE NIGHT READER'S DILEMMA

Touch article names to read full threads

DISTRO 09.13.13

INBOX

MORE WEDGE, LESS EDGE, NO HEDGE
ISSUE 106, SEPTEMBER 6TH, 2013

"I speak as someone in the core demographic Nintendo is targeting with this device: the parent of 9, 7 and 3 year old boys. Honestly, they should have launched at $99. No one buys anything in the DS product line for themselves. They buy for their kids, so cost is key. Under a Benjamin is key to winning spousal acceptance. And *thank you* for getting rid of the hinge. By far the biggest weak point, from a durability standpoint, in all the previous DS devices…"

—JONATHANGAHAN

"I kind of like the form factor of the 2DS. It's in a natural shape and set-up reminiscent of a console controller, so it should be much more comfortable to handle as opposed to the 3DS. The shoulder triggers are right where you'd expect them to be: on the top corners, instead of cramped behind the upper screen. The face buttons are where your thumbs will naturally rest. If there's a market for competitive 3DS gaming, I think pros would prefer this over the 3DS."

—MAXIMO

COOKING IS GOOD FOR NERDS
ISSUE 106, SEPTEMBER 6TH, 2013

"This is great. I just e-mailed it to my 18 y.o., first-year student, network administrator, tech-savvy son.

Maybe his mom and I will arrive home to the smells of a warm meal some time in the future. Doubt it though. :-)"

—RICKYCHOCBILL

"'Cooking is Applied Chemistry/Physics…' nuff said."

—CYBERSAMURAI

"I think this is true in part, but cooking isn't just good for nerds. It's good for everyone. Not every cook understands all of the logical properties that make it fun and game-like for you. I think of myself

as nerdy, but what I enjoy most is the complex flavor that just doesn't exist when you go fast food or frozen dinners..."

— **JUSTINWATSONJAMES**

LENOVO IDEATAB A1000
ISSUE 106,
SEPTEMBER 6TH, 2013

"Finally a budget tablet with front speakers. This is needed if you want to use them for the kids in the car attached to the headrests, I want the sound to be sent to the kids, not to me."

— **FERNANDOS**

"Audio quality is extremely important with any media. Headphones are fine for a phone, but a tablet needs much better speakers especially if you are out and about and two or more people are gathered around for a movie on it or show or whatever. Tablet speakers need to be rethought. Less focus on thinness and more focus on moving air to reproduce deep rich bass from bigger magnets and soaring highs from quality tweeters."

— **MILSPECDROID**

KOBO AURA
ISSUE 106,
SEPTEMBER 6TH, 2013

"Thanks for the review. In the future can you look closer at minimum brightness? Unfortunately, I think this is a much-neglected spec. I feel my Paperwhite is slightly too bright when reading in bed at night next to the wife."

— **BIGREDHDL**

"What price did the original Kindle's start at? And they sold OK. I know my K3 was almost $200 and I don't regret that at all. Is it ever worth it? Yes! Is it worth it to everyone? No. If you read a lot and want long battery life and lighter weight than a tablet they can be worth it."

— **DAZRIN**

THE BEST AND THE REST OF IFA 2013
ISSUE 106,
SEPTEMBER 6TH, 2013

SAMSUNG GALAXY NOTE 3

"Faux leather is interesting... and the stitches look good too."

— **ARQ**

SONY QX100 & QX10

"Damn, the QX100 has the same sensor as my RX100?! I'm getting one!"

— **NNSOMETHING**

SAMSUNG GALAXY GEAR

"I call dibs on the 'White Ranger.' It's Morphin' Time."

— **JE'**

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EYES-ON

SENNHEISER MOMENTUM HEADPHONES

FASHIONABLE ON-EARS

We've seen a number of "premium" headphones come across the wire that are entirely constructed of plastic. That's not the case here, as Sennheiser employs materials like stainless steel and Alcantara for its Momentum on-ear cans. The end result is an aesthetically superior portable audio accessory that also takes comfort seriously.

THE DAMAGE: $230

Tap for detail

GET COMFY

BUILD MATERIALS

LOW PROFILE

PHOTOGRAPHS BY WILL LIPMAN

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EYES-ON

SENNHEISER MOMENTUM HEADPHONES

GET COMFY

Stainless steel sliders fixed to both earcups allow for easy adjustment to fit a variety of listener sensibilities.

PHOTOGRAPHS BY WILL LIPMAN

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EYES-ON

SENNHEISER MOMENTUM HEADPHONES

BUILD MATERIALS

Suede leather-esque Alcantara wraps both the headband and earcups for a stellar look and resting comfort.

PHOTOGRAPHS BY WILL LIPMAN

DISTRO
09.13.13

EYES-ON

SENNHEISER MOMENTUM HEADPHONES

LOW PROFILE
The audio plug gets the low-profile treatment and angled design that's *a bit* less likely to get snagged on the go.

PHOTOGRAPHS BY WILL LIPMAN

iPad

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iPHONE 5s

PRICE: $199-$399 (ON CONTRACT)
AVAILABILITY: SEPTEMBER 20TH
THE BREAKDOWN: TOUCH ID SENSORS, A7 CHIPS AND A RING OF GOLD ARE HIGHLIGHTS OF APPLE'S 2013 FLAGSHIP LAUNCH.

To Apple faithful, iPhone day is as much a holiday as Thanksgiving (and much more so than, say, Columbus Day), and it typically only comes once a year. This time, however, was a little different, since we received even more presents than usual — both the iPhone 5s and the 5c. As you may have already heard, the 5s is rather similar in overall hardware to the iPhone 5, though there are a few changes in key places. It's now available in three colors: space gray, silver and gold.

While the 5c may be closer to the iPhone 5 when it comes to components, the 5s is closer to it in terms of looks and feel. Consisting of the same aluminum build, chamfered edges and overall industrial design, there isn't much to the 5s that hasn't already been seen on its predecessor. Of course, this is to be expected on the odd-year version of the flagship, as current trends go, but there were a couple new elements to this par-

ticular model; it offers a dual-LED flash, and the home button swaps out the square etching for a fancier ring around the outside.

But what is that ring there for? The iPhone 5s' defining feature, frankly, is the Touch ID fingerprint sensor. The device is now capable of detecting the unique ridges in your fingertips, allowing you to bypass the passcode completely, not to mention downloading and purchasing apps and iTunes content. It's able to store up to five individual fingerprints, which is helpful if you have multiple people in your family who want to use the same device. Once everything was set up, the unit we played with worked flawlessly and made for a much faster and enjoyable experience.

Also, the gold 5s color is actually pretty nice. It's lined with white on the top and bottom, and the gold itself is a rather subtle color; it's not going to blind anybody when you take it out of your pocket. It has a little bit of a shine to it as well, depending on which angle you hold the phone at. The white version is basically the same as we've enjoyed on the iPhone 5, and the space gray is more of a gunpowder look, with black highlights on the top and bottom.

In terms of performance, the A7 promises twice the CPU and GPU speeds as the A6, so we're definitely looking forward to giving this a solid go in our full review — especially since a brief amount of time is never sufficient to judge a phone's performance. It was definitely quite fast when we used it, and didn't give us any reason to believe it can't handle most, if not all possible tasks.

iPHONE 5c

Wait, Apple unveiled two completely different iPhones on the same day? In the same year? The answer is a resounding yes, though we have a feeling Tim Cook's little surprise wasn't the most well-kept secret in Cupertino. Known as the iPhone 5c, this is the less-expensive (yet vibrant) sidekick to the 5s. All told, you get a choice of five colors and if contracts aren't your thing, the off-contract costs are $549 and $649 (16GB and 32GB).

It appears that the 5c ultimately keeps to the same spec list overall, with a 4-inch Retina display, A6 processor, LTE, 8-megapixel camera and more. A huge difference, however, is the actual build, which includes a full multi-touch display on the front and a single, hard-coated piece of polycarbonate strengthened by a frame of reinforced steel. Apple repeatedly mentioned during its event that it's "unapologetic" about the plastic build, and deservedly so — not only does it feel great, it's also the most solid polycarbonate build that we've ever laid hands on. There is absolutely nothing about this setup that makes us believe it's not capable of han-

PRICE: $99 & $199 (ON CONTRACT)
AVAILABILITY: SEPTEMBER 20TH
THE BREAKDOWN: IT'S NOT THE LOW-COST iPHONE WE EXPECTED, BUT APPLE OFFERS COLORFUL OPTIONS FOR THE iOS FAITHFUL.

Click on product names to read full stories

dling wear and tear, and the reinforced steel frame convinces us that it's even going to survive falls without a problem.

Speaking of which, the 5c has a glossy finish, but we were quite happy to find that it's not the fingerprint magnet that we've come to expect on other devices. It sufficiently handled the greasy fingerprints of a couple hundred journalists, so we doubt you need to be concerned about this phone looking dirty when it's just you handling it. In fact, it has a subtle shine to it that serves to complement the vibrant colors.

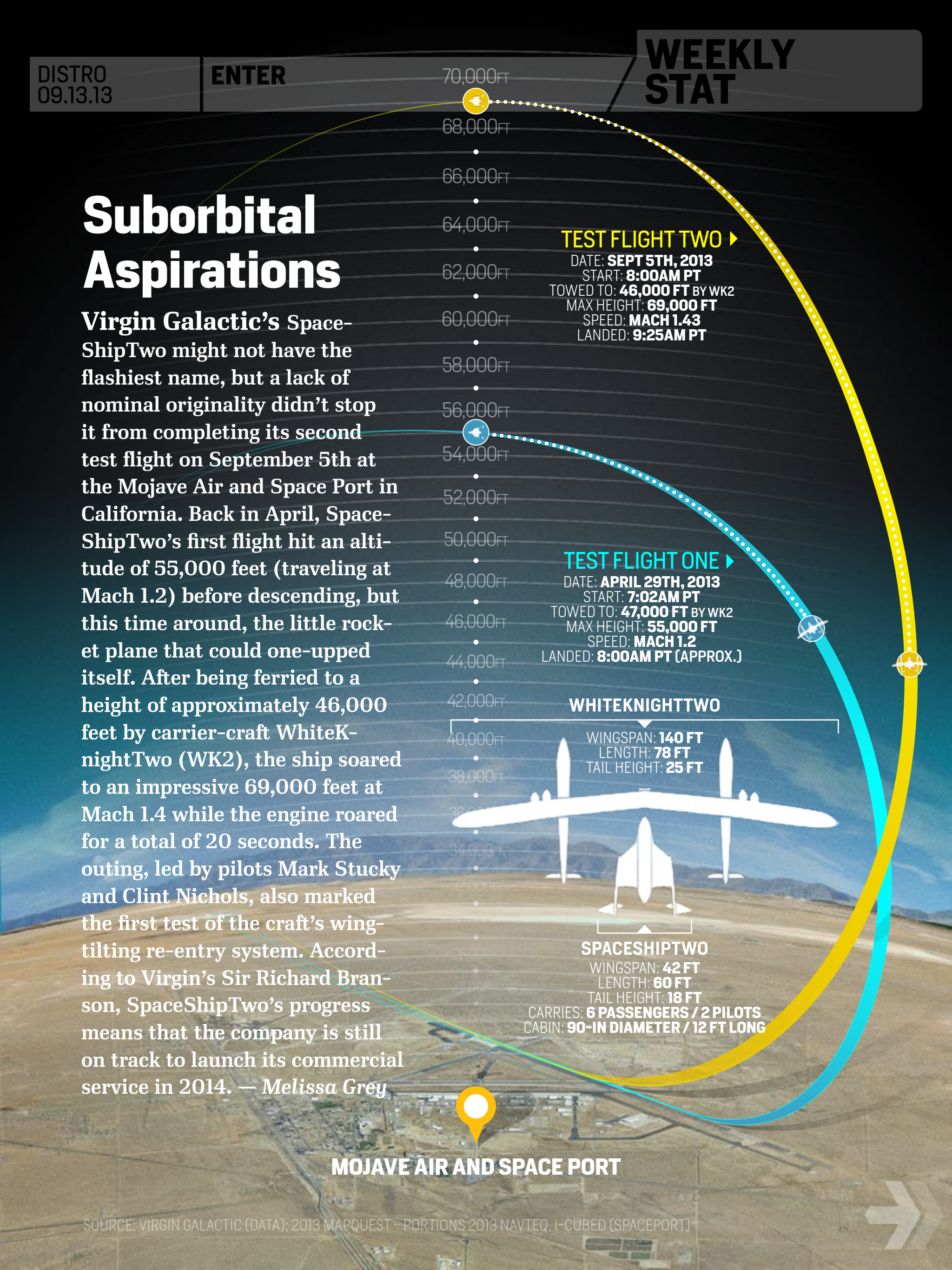
As we mentioned earlier, this is the spiritual successor to the iPhone 5, and much of the layout reflects that. The camera, buttons and ports are all in the same places, with the only difference being the bottom edge of the device: instead of two sets of speakers flanking the Lightning port, the 5c features only four individual holes lined up to its right.

Apple heavily emphasized the idea that iOS 7's colorful UI makes the 5c even better, and we have to believe it; given the five different hues, the new OS really works well this way when you choose a color scheme to match the hardware.

Overall, the 5c offers the same speed and performance as the iPhone 5, so this combined with the color options and solid build will help breathe new life into the mid-tier iPhone option. Given the price, it may not turn out to be the device for emerging markets, but it at least gives interested iPhone buyers more choice without making them feel like they're going with the "old" models.

Suborbital Aspirations

Virgin Galactic's Space-ShipTwo might not have the flashiest name, but a lack of nominal originality didn't stop it from completing its second test flight on September 5th at the Mojave Air and Space Port in California. Back in April, Space-ShipTwo's first flight hit an altitude of 55,000 feet (traveling at Mach 1.2) before descending, but this time around, the little rocket plane that could one-upped itself. After being ferried to a height of approximately 46,000 feet by carrier-craft WhiteKnightTwo (WK2), the ship soared to an impressive 69,000 feet at Mach 1.4 while the engine roared for a total of 20 seconds. The outing, led by pilots Mark Stucky and Clint Nichols, also marked the first test of the craft's wing-tilting re-entry system. According to Virgin's Sir Richard Branson, SpaceShipTwo's progress means that the company is still on track to launch its commercial service in 2014. — *Melissa Grey*



SOURCE: VIRGIN GALACTIC (DATA); 2013 MAPQUEST – PORTIONS 2013 NAVTEQ, I-CUBED (SPACEPORT)

Riptide: What Really Happened to the News Business

John Huey, Martin Nisenholtz and Paul Sagan
Nieman Journalism Lab

You'll need to set aside a fair bit of time for this one. Put together by John Huey, Martin Nisenholtz and Paul Sagan for Harvard's Shorenstein Center and Nieman Journalism Lab, this essay / website / book attempts to explain "what really happened to the news business" amid the rise of the internet and digital technology. To do that, the three interviewed more than 60 people from both fields, from Tim Berners-Lee and Eric Schmidt to Arthur Sulzberger and Donald Graham, and it goes back to the beginning, so to speak, to some of the earliest digital technologies for delivering news. As you might expect, there's hardly a consensus from the participants involved, but it makes for some fascinating reading whether you're in the news business or not.

BILLY STEELE

Click on headlines to read full stories

The Steely, Headless King of Texas Hold 'Em
By Michael Kaplan
The New York Times
A look at technology's influence on another industry, this piece from Michael Kaplan for *The New York Times* examines how poker machines are getting smarter than ever, with neural network technology making the games even more challenging for human players — so much so that the machine's creators say they've had to "dummy it down" so there's a chance of winning.

Ashes to Ashes, Peer to Peer: An Oral History of Napster
By Richard Nieva, *Fortune*
Now 15 years on, Richard Nieva looks back at the history and influence of Napster in the form of an oral history. That includes comments from those who worked with the company and those who challenged it, although both Shawn Fanning and Sean Parker declined to be interviewed.

Random Access Memories: My Time at a Singularity Conference
By Casey Johnston, *Ars Technica*
Ars' Casey Johnston recounts the somewhat strange scene at the recent Global Future 2045 conference, where humanoid robots mingled with those who hope to one day be able to transfer their consciousness into such a creation. That includes the likes of Ray Kurzweil and conference founder Dmitry Itskov, who unsurprisingly also have their share of critics and skeptics.

From "Can We Talk?" to a Coffee-Table Mishap — The Inside Story of Microsoft's Nokia Deal
By Ina Fried, *All Things D*
We've heard plenty from Microsoft and Nokia publicly since their multi-billion dollar deal was announced, but this piece from Ina Fried for *All Things D* offers plenty more details of what was happening behind the scenes in the preceding months, including an unfortunate encounter between Steve Ballmer and a glass coffee table.

TAP TO CONTINUE.

THE iPHONE 5c ISN'T YOUR LOW-COST SOLUTION

BY DARREN MURPH

The iPhone 5s was expected. The iPhone 5c, on the other hand, was merely *rumored*. Now that Apple has taken the wraps off of two new iPhone products, it's the newest range that strikes us as the most curious. For months, pundits have wondered if and when Apple would attack two obvious markets: the large-screen market — which Samsung is lapping up in supreme fashion at the moment — and developing markets. The iPhone 5c addresses neither of those, which begs the question: who exactly is Apple targeting?

Perhaps the biggest debunk of Apple's entire event was that the iPhone 5c was going to be a "low-cost device." Given that carrier subsidies can and will vary across the globe, let's look at raw pricing. The base 16GB iPhone 5c will sell for $549 sans contract in the US; before the event, the base 16GB iPhone 5 was listed for $649. In other words, the iPhone 5c — which is likely monumentally less expensive to assemble and uses dramatically less costly materials — is priced just 16.6 percent less than the phone it replaces. One could argue that Apple is potentially saving even more than said difference by relying on plastic for the exterior. The bottom line? The iPhone 5c is a high-margin device, just like every other phone that Apple has ever built.

In my estimation, this is Apple's attempt to make the iPhone lively again. After six years, a certain amount of fatigue has set in. The "throw colors at it" approach has worked beautifully for Apple in the past. The company's sauced up a variety of previous iPod products with new hues, and remember: this is the company that once offered *socks* in a variety of colors. The iPhone 5c isn't for feature phone users in emerging markets. It's also not for the spec hounds who will be buying an iPhone 5s regardless. By and large, it's a marketing tool to get the masses to pay attention to the iPhone name. Mark my words — the first prime-time iPhone ads you'll see following this week's event will not highlight the iPhone 5s; Apple's already planning to sell one of those to almost every iPhone 5 owner. What you'll see instead are buckets of

paint, upbeat music and a revitalized theme surrounding the word iPhone.

The iPhone 5c, simply put, is for those who've grown numb to Apple's largely evolutionary takes on its primary iPhone range. It'll attract a younger audience that cares less about finely beveled edges and more about playing *Connect 4* on their iPhone case. It'll cater to the same crowd that has looked longingly towards the $599 (again, off-contract) Moto X — a phone for the mainstream, and a phone that's as colorful as one's soul. In a way, this is the anti-Moto X. From a price, spec and feature perspective, it's a match that's too close to call. The iPhone 5c's camera has an edge on the Moto X, but the X's Active Display is a boon for notifications. As these things tend to go, a lot of it boils down to ecosystem preference. The iPhone 5c is being built for the same audience as the flashy iPod nano, and moreover, Apple built it for those on Wall Street who feel that it simply *must* attract new markets to stay atop its game.

Apple never showed intentions of racing the Nexus 7 to the bottom in the tablet game, and the iPhone 5c is proof that it won't do that in the phone arena, either. D

FOR SAMSUNG, MORE IS MORE

DISTRO
09.13.13

FORUM

SWITCHED ON

BY ROSS RUBIN

MOTOROLA'S RETURN to the smartphone market after a year ensconced in Googliness raised many questions about how the handset pioneer would introduce a competitive smartphone without appearing to have most-favored manufacturer status from Google. The company responded in two ways. First, instead of trying to smother the look and feel of Android, it embraced it nearly to the extent of a Nexus phone. Second, it added a few thoughtful differentiators. These include a pulsing time display that adds notifications even when the screen is off and camera activation via a twist of the wrist. More notably, it enhanced access to Google Now by enabling hands-free activation with the prefix, "OK, Google Now…"

LG, another Android handset company that had fallen from feature phone grace, came next with its G2. Like the Moto X, the G2 implements some clever sensor-driven and gestural features, including a "knock" (double-tap) to activate the screen and an automatic call-answering feature activated by putting the phone up to your face. But unlike Motorola, LG muscled up its device with

“Samsung continues to seek power user justification for its S Pen.”

a nearly bezel-free 5-inch display, a battery that more efficiently fills the case, a 13-megapixel camera with optical image stabilization and the flagship Qualcomm Snapdragon 800, which sees its US debut in the G2. (LG also highlighted much of its rear-mounted power and volume control placement, which is different, but not necessarily better (at least for the right-handed).

If these kinds of usability-focused enhancements have raised any questions for Samsung, which has seemingly piled on whatever it can think of into its smartphones, the global smartphone leader is turning a deaf ear. With their latest phones, Motorola and LG have focused on driving convenience in addressing common scenarios. But with the Galaxy Note 3, Samsung continues to seek power user justification for its S Pen. The stylus’ box gesture, for example, which allows you to embed one app anywhere on the screen, is not only a power user feature, but also one that could be achieved without Samsung’s fancy little stick. Samsung also pours its energy into a lot of functionality that replicates things built into Android or common apps. Adding on to the likes of S Voice, ChatOn and WatchOn, the company has added Scrapbook, a tidbit-collection facility that competes with Evernote even as it integrates with it, and My Magazine, a Flipboard-clone put to work to compete against HTC’s BlinkFeed.

Perhaps the best examples of Samsung’s love of features that embrace marginal utility are ones that require multiple Galaxy smartphones to work. Topping a Group Play feature that allows one to use four Galaxy smartphones as surround speakers (despite smartphones being infamous for poor-quality speakers), the company added Multi-View, which allows you to line up four Galaxy Notes and play a video that stretches across their displays. Creators of tiny video walls rejoice.

Perhaps there is a method to the madness; Samsung could be seeking to differentiate itself for those who embrace technology for technology’s sake, who buy into the promise of the possible versus the practical. Many features that we take for granted and use today were once considered experimental, gimmicky or derivative and Samsung may just be hedging its bets. But bleeding-edge features that approach the status of demos do not line up with the enormity of the market that buys even Samsung’s flagship phones (or perhaps four of them). For Android handset vendors such as Motorola and LG, and others who would like to cut into Samsung’s massive market share, there may be opportunity in drilling home that their feature sets are not just fun, but also functional. D

THE WARM EMBRACE OF THE MACHINE

DISTRO
09.13.13

FORUM

THIS IS THE MODEM WORLD

BY JOSHUA FRUHLINGER

My glasses are about 5 years old. I realized last week that it's probably high time to replace them. Besides, I needed a new contacts prescription and, for all I know, my eyes have completely changed in those short five years. It's also important to mention that my glasses look like they're about 5 years old, so yeah, it was time.

I pulled up Yelp and sought out an optometrist in the area who accepted my form of vision insurance. I made my appointment online. I received an email confirmation shortly after. The day before the appointment, I received a robo-call reminding me of the time and location.

At this point I hadn't spoken to a human. I interacted with three machines, though: Yelp, the office's website and their robo-caller. It wasn't until I stepped into the office that I saw an actual human. He gave me some paperwork to fill out. I complained that I had already entered all this information into their website, and he apologized, saying that the two systems weren't yet connected, but it'll happen soon, he assured me.

I was shortly shuffled off into an anteroom stuffed to the walls by a buffet of machines. I sat on a wheeled chair at the left end of the buffet and, as instructed by the assistant, made my way to the right, machine by machine. One checked my peripheral vision with a series of squiggly images that I had to signal to the machine I could see using a single-button remote. Another puffed air into my eyes to check for glaucoma. The next digitally checked my prescription with a series of images and shutter sounds that required no active feedback from me — "just to get an estimate before a human checks for sure."

When I reached the end of the line, the assistant poked his head above a machine and asked, "Do you have anything you need to do this afternoon?"

"Umm…" I panicked. I was waiting for some horrible news about the health of my eyes, that I was about to be told I needed immediate surgery and did I have any emergency contacts they could call. "No?"

"The doctor is going to want to check the health of your eyes. Have you ever been dilated?"

Sure I have. "Sure I have," I replied.

"Okay. Well, your insurance covers that. Oorrr…" he gazed at a giant ma-

“For $35 you can just stick your face in that machine and it’ll take detailed pictures of your eyes.”

chine in the corner behind me. I spun around. It resembled a beige Recognizer from *Tron*. “For $35 you can just stick your face in that machine and it’ll take detailed pictures of your eyes and you don’t need to be dilated. It’s not covered by insurance, but you don’t need to be dilated for it.”

I could handle $35 to avoid the discomfort of whatever it is they put in your eyes to dilate them. Within five minutes and a couple trials and errors, and I had my eye pictures taken and was sent back to the waiting room. In a very big way, I felt comforted that a machine would do the work accurately as opposed to a human who might make mistakes.

It wasn’t until almost an hour later that I finally sat down with a real human doctor. She verified the machine’s findings, asked me some lifestyle questions, helped me choose the right contact lens brand, made some jokes about cat allergies to lighten the mood and sent me on my way.

And then I realized something: We find comfort in machines. Humans check their work and make qualitative decisions, of course, but one could easily imagine a doctor visit in which all you do is stick your appendages in various machines, get a readout and take that to a doctor elsewhere to make a few decisions about treatment. In my case, by the time the doctor entered the examination room, she had already reviewed the Optomap’s pictures of my eyes, had a baseline prescription from another machine and knew that I had some slight astigmatism. And I was completely fine with that.

When given the choice between a machine or human testing something when it comes to my health, I’ll choose the — seemingly — more accurate machine every time. We’ve all been conditioned to think this in other arenas as well. A trip to a modern casino reveals that what were once cranky machines with idiosyncratic gears and levers are now computer-regulated robots that take the human element out of something as simple as pulling a crank arm on a slot machine. Sure, you can still pull the arm if you want, but it’s just triggering an electronic mechanism — it’s no longer ratcheting up the machine. And we’re all okay with that. The casino loves its no-fault accuracy, and customers feel confident that no one is trying to cheat them.

In short, we find comfort in machines’ inhumanity. Let them give us the black-and-white numbers, and then we, as humans with feelings, will interpret the data as we see fit. We’ll interact with machines as long as possible until that final moment when we finally call upon the services of a human expert to make things real again. D

REVIEW

CONTENTS

DISTRO
9.13.13

Nokia Lumia 625

LG G2

REVIEW

NOKIA LUMIA 625

Does the Lumia 625 pack enough improvements to garner an upgrade from the existing 620 handset?

By Jamie Rigg

Another week, another Lumia. This latest grenade thrown by Nokia in its continued assault on the smartphone market is the Lumia 625. Following up on its previous high-end devices — the good-looking one, the one with the fancy camera — the 625 is a soldier of lower rank. There's already an army of budget Windows Phones that fill various niches, so what's the deal? Well, despite the number on its dog tag, the 625 is far from a Lumia 620 variant: it's a completely different phone. For starters, it sports the biggest screen of any Lumia to date (for now, anyway).

Actually, make that any Nokia phone ever made. But the real reason it exists has nothing to do with the display size; it's all about the 4G radio hiding away inside. Does LTE, plus a big screen and eyebrow-raising price tag, make it worth your while, though?

HARDWARE

The 625 is everything we've come to expect from Nokia, especially its lower-end Lumias: it's simple, colorful and fun. The phone is just a basic black, square slab when disrobed, but much like the 620, it's the polycarbonate shell wrapping the back and sides of the device that gives it personality. Up front is a single pane of Gorilla Glass 2 that curves ever so slightly at the edges to meet the thin black rim that holds it in place. Behind it sits the 4.7-inch display with a few millimeters of bezel on each side. The standard Windows Phone back, home and search soft keys sit below the screen, with a small gray Nokia logo and front-facing camera above. A tiny, almost unnoticeable nick on the bottom edge of the thin peripheral rim identifies the microphone, and a larger slit that consumes a small section of glass superior to the Nokia stamp serves as the earpiece.

There's not much to see around the edges of the device, which are covered by the one-piece polycarbonate shell. The top is

Similar to the 620, the 625 is draped in a removable shell.

home to the 3.5mm headphone jack, while the micro-USB port for charging and data transfer sits on the bottom side, aligned with the home button. As with all Windows Phones, the right side bears the volume rocker, power key and two-step camera button. These keys are part of the shell itself, and in the one supplied with our handset, at least, they're sturdy and well-sized, so they don't wobble or drift around. Also, the camera key on our unit has the perfect amount of resistance, clearly separating the first and second shutter steps.

The back of the Lumia 625 is as clean and uncluttered as the front. Down near the micro-USB socket is a tiny oblong loudspeaker grille, and etched into the middle of the back cover is another small Nokia logo running landscape-a-ways. Above that is the main camera lens flanked by its modest LED flash module, both of which are sunken into the shell just enough to protect them from any particularly abrasive surfaces you might place the phone on. Nothing too exciting is hidden under that bright case. All you'll find is a more industrial-looking version of the loudspeaker grille and two slots on the left edge, arranged bunk-bed style, for your micro-SIM and microSD storage booster (up to 64GB cards welcome). If you were hoping for a removable battery, you're out of luck; that built-in

One side dons camera, volume and power controls.

2,000mAh unit will have to do.

Now that you know what's underneath, a quick note on getting the plastic cover off. It's one of the most awkward Lumias to unclothe, as there's nothing to use as leverage but the cover itself. On the Lumia 620, for example, you have the camera / flash module to push down on while you work the case off. With the 625, however, you have to plant a thumb somewhere in the top half of the case, and kind of *pry* it off from the micro-USB end (there are teeth on the top inside edge of the cover that prevent the reverse maneuver). What this means is to get the shell off, you effectively have to bend it around a pseudo-hinge you create with your thumb.

At first, we were worried about it stretching. You see, to the phone's credit, the shell fits incredibly tightly to the frame, and it's hard to find an area where it gives or creaks. It feels like a complete device and you get a sense that Nokia spent a decent amount of time measuring things up to ensure as much. As it turns out, our concerns were ill-founded. After removing the case upwards of a hundred times, we decided it had no impact: the shell seemed to fit as snuggly as it always had. Then, the *incident* occurred — it cracked during one particular removal, right by the power key. It gave up at the point that suffers the most as you bend the cover; in other words, where it bears the most physical stress. However, we probably weren't as careful or gentle with the shell as we could've been; another Engadget editor using the 625 suspects the break was less about flawed design, and more about oafish technique.

As we've said, the back covers are what make this a Lumia. Classic black and white, plus mint green, bright yellow and red-orange are the official case colors. Our unit came with the latter, and rather than it being a solid, block color, it reacts to changing light. This is due to the "dual-shot color" shell construction, just like on the 620, which produces a semi-transparent effect and adds a certain depth that means the etched logo appears to float on the surface. Our particular model had a white base with a red layer on the top, hence the orange result. The 625 may not be as pleasing to the eye as, say, the gorgeous 925, but looks certainly weren't an afterthought. It's something of a younger, chubbier and less-serious version of the Lumia 720, which itself is a pretty charming package.

Nokia's Lumia 625 may be the largest phone the company's ever made, but don't be fooled by the record. These days, it's hard to figure where the line separating tablets from phones is anymore. With a 4.7-inch LCD display and dimensions of 133.2 x 72.2 x 9.2mm (around 5.2 x 2.8 x 0.4 inches), the 625 is most definitely a smartphone — you could even consider it a little on the small side compared to everything else that's hitting the market. It's not the thinnest, or the lightest, at 159g (5.6 ounces), but it's well-balanced and contoured. All the corners and edges are rounded off, and the shell is margin-

SPECIFICATIONS	NOKIA LUMIA 625
DIMENSIONS	133.2 X 72.2 X 9.2MM (5.2 X 2.8 X 0.4 INCHES)
WEIGHT	5.6 OZ. (159G)
SCREEN SIZE	4.7 INCHES
SCREEN RESOLUTION	800 X 480 (201 PPI)
SCREEN TYPE	IPS LCD, SENSITIVE TOUCH
BATTERY	2,000MAH LI-POLYMER (NON-REMOVABLE)
INTERNAL STORAGE	8GB
EXTERNAL STORAGE	MICROSD (UP TO 64GB)
REAR CAMERA	5MP, F/2.4
FRONT-FACING CAM	0.3MP (VGA), F/2.8
VIDEO CAPTURE	1080P @ 30 FPS
NFC	NO
RADIOS	GSM (850 / 900 / 1800 / 1900) WCDMA (850 / 900 / 2100) LTE (3 / 7 / 20)
BLUETOOTH	V4.0 WITH LE, OPP, A2DP
SOC	QUALCOMM SNAPDRAGON S4 (MSM8930)
CPU	1.2GHZ DUAL-CORE
GPU	ADRENO 305
RAM	512MB
WIFI	DUAL-BAND, 802.11B/G/N
WIRELESS CHARGING	NO
OPERATING SYSTEM	WINDOWS PHONE 8

ally convex, so it rests nicely in the palm. This editor can just about reach all four corners of the screen without stretching and is happy with the handset's quiet pocket presence. No one would mistake the 625 for a premium handset, but then again, Nokia's not trying to deceive anyone, either. This phone is sturdy, fun and agreeable to use, which is more than satisfactory considering the price.

DISPLAY

Where to start? Well, let's look on the bright side, if only to soften what's to come. Discounting the high-end Lumias, all of which sport 4.5-inch displays, the 625's screen exceeds its nearest brethren by 0.4 inch — the 720 and 820 both have 4.3-inch windows to work with and, if you've been paying attention, you'll know we're looking at 4.7 inches on the diagonal for the 625. In some circumstances, bigger is better. Navigating through menus, peeking at the Live Tile home screen, framing a photo and poking at the on-screen keyboard are some of the tasks that are just inherently easier on a larger screen. Colors are vibrant enough, and whites are accurate, but after that, we begin to run out of complimentary points.

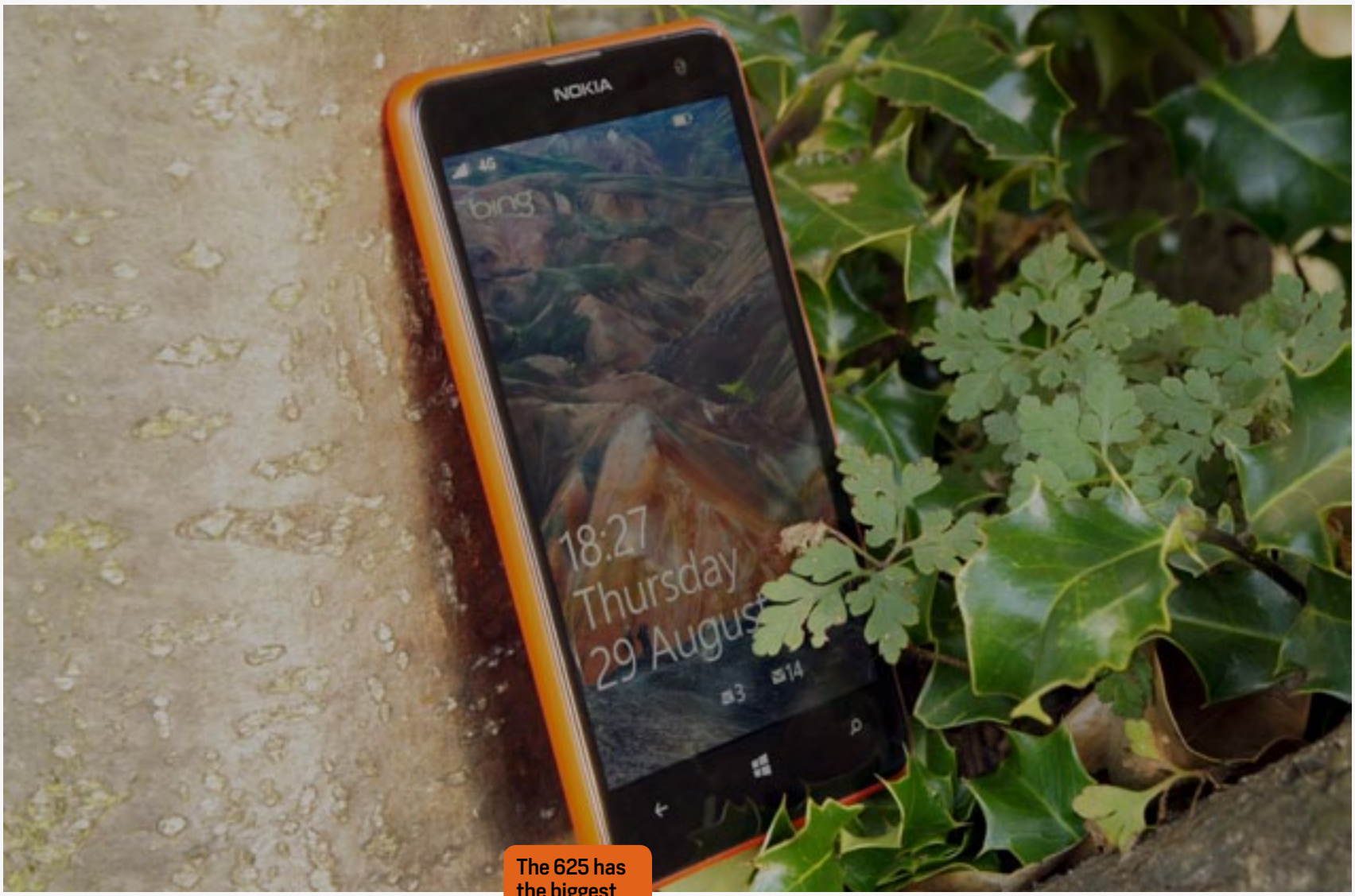
While the IPS LCD display has Nokia's glove-friendly Sensitive Touch technology, ClearBlack is missing... and missed. The 625 falls short in many of the same areas the Lumia 520's panel did. Blacks often look like navy, and although it's not always easy to spot,

ClearBlack is missing... and missed.

the display is patchy and over-lit on the bottom edge, above the soft keys (this is easier to spot with dark images). Then, there's the resolution. When we reviewed the Lumia 720, we felt the need to defend its mediocre pixel density — after all, the WP8 UI doesn't suffer from a low-definition screen, and the 625 is further proof of that. But, stretching 800 x 480 pixels across a 4.7-inch display results in an almost upsetting density of 201 ppi. It's not the end of the world or anything, especially if you're just poking around WP8. It is irritating in several situations, however. You'll find it lacking detail when browsing desktop sites or using the camera, for example. At the same time, it'll do the job if you just want to catch up on the odd TV show. Anything 720p or above, though, means you'll be looking at more black bar than anything else.

Aside from the resolution, viewing angles are pretty poor, and the slab of Gorilla Glass 2 covering the entire face of the phone holds on to more grime and fingerprints than we'd like. Outdoor visibility isn't too bad, really. The panel is bright enough in most situations, but glare

The display doesn't handle video above 720p very well.



The 625 has the biggest display of the Lumias, but not the best.

can sometimes get the upper hand. It might be the biggest display of any Lumia, but it's far from the best and honestly, a little disappointing. But, at least it's not too hard on the battery, right?

SOFTWARE

What's Windows Phone 8 like on the Lumia 625? Well, it's like Windows Phone 8 on other Lumia devices. Those who have been treated to the recent Amber update, anyway. The new version — comprising Microsoft's GDR2 update and Nokia's input — comes pre-installed on the 625. On top of the original experience, it brings various fixes, tweaks image processing and adds an FM radio player, as well as the new Data Sense app for tracking those megabytes. Also, Xbox Music and Internet Explorer have been tuned up, and finally, much to this editor's glee, CalDAV and CardDAV calendar and contact formats are now supported, making it infinitely easier to get Google accounts synced up. It really is a breeze.

Unfortunately, hardware limitations of the Lumia 625 mean you miss out on some of Nokia's goodies. The Glance Screen feature, which leaves the display on in a low-power state, permanently showing a clock and any relevant notifications, is not available on the 625. While Nokia claims this is because of inadequate "display memory," it's re-

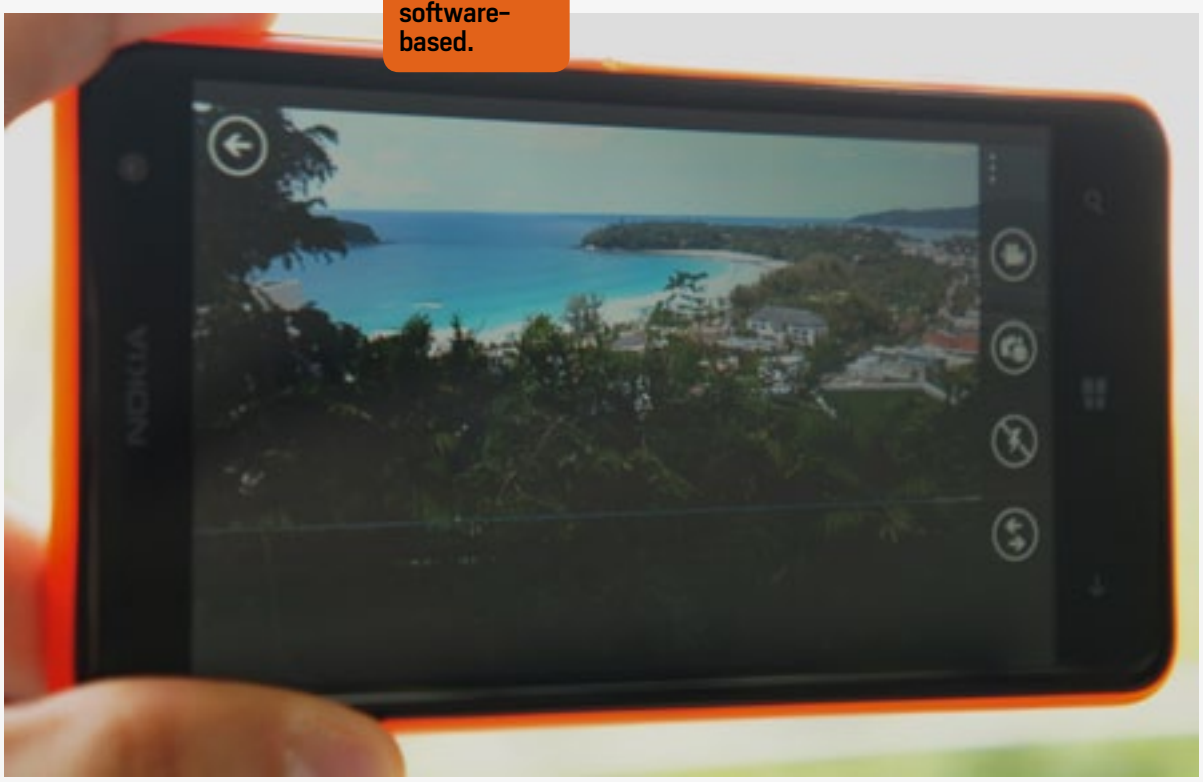
ally due to the LCD display, which would munch battery life if always lit, even on a low brightness setting. (With AMOLED screens, only the pixels in use need be active.) The Pro Camera app, also from Nokia, isn't compatible with the handset: you need a 920 or above for that perk. Smart Camera is your consolation app, however, and comes pre-installed alongside the older Cinemagraph. Nokia's cloud-compression Xpress browser is pre-loaded, too (although we tended to stick to the more familiar IE experience), as is the beta for App Social, a software-recommendation service.

The Lumia 620 got lucky when Nokia decided to bundle the global Drive+ navigation service with it. Since then, all other budget Lumias have made do with the local, non-plus version, 625 included. The only other software of note that's on the phone from the get-go is bloatware. Luckily, you're only looking at the World of Red Bull portal, and the *Angry Birds Roost* dedicated store / content service-type thing. Both are easy to uninstall. There's nothing unique about Windows Phone 8 on the Lumia 625. In fact, we feel like we're missing out by not being able to toy with the Glance Screen feature or Pro Camera app. In short, if you've ever poked around in Microsoft's mobile OS before and have peeked at the GDR2 / Amber changelog, you already know the score.

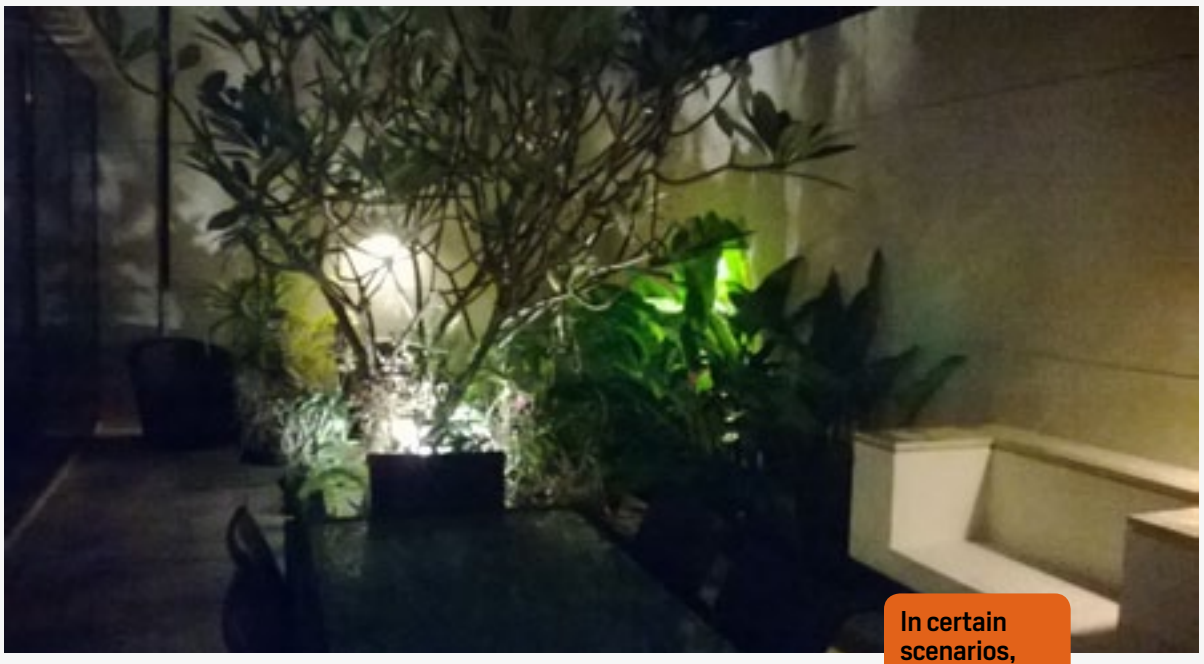
CAMERA

While Nokia's Lumia 1020 is currently *the* cameraphone of the moment, the 625 is at the other end of the spectrum specs-wise. The main shooter is a 5-megapixel affair (not backside-illuminated), with an f/2.4 lens and small companion LED flash. Before we get to the nitty gritty, let's deal with the front-facing VGA (640 x 480) camera with f/2.8 lens quickly. Long story short: it's not great. Even in fantastic conditions with a wealth of natural light, images were a bit noisy for our liking. Not that we were expecting the earth from a VGA shooter, and at least you can spice up your selfies with Nokia's Glam Me app, if inclined.

Now, back to the main



Gripes with the camera are mostly software-based.



In certain scenarios, we managed some decent snapshots.

camera. Our sample images were a bit of a mixed bag, really, but we want to point the finger at software, to some extent. The default camera app is the opposite of Pro Camera, in which you have manual settings that offer a lot more control. Apart from tinkering with scene selections where appropriate, we left the ISO, exposure and white balance settings on auto. Incidentally, we were impressed with how quickly the core camera app loaded up, as we've been irritated by the boot times in budget Lumia reviews of old. Whether that's because the 625 packs a slightly faster processor than other budget Lumias, or whether the slow start-up time has been addressed in the Amber update, we're not quite sure. The Smart Camera "lens" is almost as quick to load, while others like Panorama and Cinemagraph still take a few seconds. Even if you can't fiddle with many of the settings in the core app, at least it's there when you need it for opportunistic shots. Shutter response is also greatly improved over old budget Lumias. In favorable lighting conditions (i.e., when the phone doesn't hang to suck up more light), you can snap successive shots pretty rapidly, at maybe two per second.

As you can see from the sample images, colors went from well-represented to pale and lifeless, depending partly on the lighting conditions, but, mostly, based on our distance from object. White balance was accurate enough — it was light metering and the automatic exposure compensation that were often off the mark. In close-up situations, images tended

to be slightly overexposed and washed out. In landscape scenarios, the opposite was true, with pictures coming up dark and underexposed. We might have had more success if we committed to manually adjusting exposure, but ain't nobody got time for that. The few well-balanced, well-lit shots we did achieve, however, show that, with a bit of TLC, you can squeeze some acceptable images out that 5-megapixel sensor.

Considering the sensor is not back-side-illuminated, we were surprised by its low-light capabilities. You need a really steady hand to keep a snap in focus, but wait long enough for the 625 to inhale the light it needs, and *voila!* What was pitch-black in real life becomes a grainy, noisy, slightly out-of-focus image of whatever you were pointing your phone at. You won't be winning any photography competitions, but at least you've recorded what you intended to. That small LED flash delivers a substantial kick for its size. Up close, it's too bright for its own good; too far away, and the 625 slacks off in its low-light duties, believing the flash will do all the work. At mid-range, however — say, four to six feet — it's better on than off.

Low-light performance when recording at 1080p (30 fps) is understandably much worse than stills. When it's truly dark, video is useless, although the fact that audio capture isn't half bad means at least you have something to listen to. In twilight, it's better, if not a tad grainy, and in good conditions, it takes a pretty nice clip, with consistent focus and exposure. You'll want to move your pictures and video onto something with a better screen before peeking at them, though. As you can probably guess, you're not seeing anything close to full picture or video quality on that 201-ppi display.

PERFORMANCE AND BATTERY LIFE

As we explained exhaustively in our review of the 720, Windows Phone 8 devices fit into two distinct classes. You've got phones like the budget Lumias and the HTC 8S that share basically every spec, including a 1GHz processor and 512MB of RAM; then you've got the higher-end handsets with at least a 1.5GHz processor and 1GB of RAM. There is one device, the Huawei Ascend W1, which ignores the rules with a dual-core 1.2GHz CPU. Well, we guess this is now a tier of its own in some respects, as the Lumia 625 also has a dual-core 1.2GHz CPU — the MSM8930 Snapdragon S4 (Krait) with Adreno 305 GPU, to be exact — paired with 512MB of RAM. You're also looking at 8GB of internal storage that you can boost with microSD cards of up to 64GB (there's 7GB of free SkyDrive space thrown in, too), and a 2,000mAh, non-removable battery.

As the benchmarks show, the 625 rivals the Ascend W1. Both are just that little bit better than the tier below, but don't score as well as higher-end handsets. Having played with all the budget Lumias, that slight increase in proces-

BENCHMARKS	NOKIA LUMIA 625	HUAWEI ASCEND W1	NOKIA LUMIA 520	NOKIA LUMIA 620	NOKIA LUMIA 720	HTC 8S	NOKIA LUMIA 1020
WPBENCH	212.1	212.25	178	180	179	180	**223**
BATTERY RUNDOWN	3:54	2:57	2:41	3:41	**4:36**	3:30	2:12
SUNSPIDER	1,128	1,127	1,400	1,443	1,440	1,415	**906**
ANTUTU	9,835	9,281	7,350	7,479	7,348	7,333	**11,084**

SUNSPIDER: LOWER SCORES ARE BETTER

sor clock speed does make a difference. Everything loads slightly quicker, and navigating the Windows Phone UI feels a tad slicker. That 512MB of RAM is a bummer, though. We wish Nokia would just understand that people are willing to pay an extra five bucks to get the full one gigabyte, and access to all the apps that require it (*Halo: Spartan Assault*, for example). The original *Temple Run* launched on WP8 with such a requirement, as did Nokia's own Xpress browser, for that matter, but both now work with 512MB of RAM. Unfortunately, our favorite artifact thief drops several frames during his eternal escape. The game runs noticeably choppy on the 625, and we imagine it would be fine if we had those extra megabytes of memory.

The Lumia 625 boots from dead to usable in around 20 seconds, and once it's up and running on a full charge, it won't be forced to sleep again for quite some time. As the battery rundown test shows, that 2,000mAh pack really lasts. Maybe not as long as the Lumia 720's, but you'll still easily get a full day of power use out of it, or two days under normal circumstances — some browsing (over LTE), taking a few pictures, listening to music, a few phone calls, emails, etc. The usual. We already mentioned that the display isn't a videophile's dream, and unfortunately, audio isn't the Lumia 625's *forte*, either. It's an acceptable tune machine, but max volume isn't particularly loud, and sound definition / levels aren't the best we've ever heard. The loudspeaker is no different than it is on most phones: tinny.

LTE is the 625's main weapon. Its USP, if you will. Well, we're happy to report that the chip in our handset worked as advertised. Our best speed test over 4G was 36 Mbps on the download and 16 on the upload. Download speeds were more in the region of 5 Mbps to 10 Mbps in central London due to network congestion, but for the vast majority of the time, we were browsing just as fast as IE could keep up. IE is pretty smooth in general, and though tiling while zooming in and out is noticeable, everything rebuilds so quickly you have to *forcibly* notice it. In

other miscellany, WiFi range and connections are solid, GPS lock-on times are frighteningly quick and call quality is, well, just fine.

WRAP-UP

So, does Nokia need another budget Lumia? Well, yes. We get what the company was trying to achieve with the Lumia 625: 4G on a shoestring. In that respect, mission accomplished. We can't help but feel, though, that Nokia hasn't quite nailed the niche that it set out to, leaving space for a similar budget offering that's LTE-capable, and better executed.

We're not sure whether any of the big US carriers will add the 625 to their roster yet. In the UK, however, where Vodafone and O2 have just joined EE in the LTE club, the handset can be had for £179 (close to $280) on pay-as-you-go, or free from £21 (almost $33) per month on contract. (It's available on all three 4G networks). For that kind of money, the 625 is a pretty attractive proposition, but it could be better. Would it have killed Nokia to put an extra 512MB of RAM in there, especially since it went to the trouble of upgrading the CPU from previous budget efforts? Furthermore, the handset could've done with a smaller display, even if it would've made it slightly thicker. Keep the same resolution and preserve the battery life; just improve the ppi and make it Glance Screen-compatible. Alas, it's too late now. It's not a terrible device by any means, but, despite the 4G radio, it didn't charm us like the 620 did. Maybe the Lumia 725 will. D

Daniel Orren and Edgar Alvarez contributed to this review.

Jamie Rigg is a Contributing Editor at Engadget, and a total sucker for any tech he really doesn't need.

BOTTOMLINE

NOKIA LUMIA 625

£179 (PAYG)

PROS

- 4G-capable
- Good battery life
- Inexpensive
- Pleasing design, comfortable to hold

CONS

- Disappointing display
- Only 512MB of RAM
- Average camera

BOTTOMLINE

A classic, colorful Lumia that offers LTE for a reasonable price. But, its obvious flaws mean it could've been so much better.

REVIEW

LG G2

LG's G2 packs a hefty battery, rich specs and expansive screen, but will the unique rear-button layout throw potential buyers for a loop?

By Mat Smith

There are a lot of smartphones out there now. You know this. To add to the confusion, many companies are now parading out multiple top-drawer phones: think Samsung's Galaxy S and Note series, or the Xperia Z and Z Ultra from Sony. Even LG, whose new G2 flagship I'm poring over this time around, has both the G and G Pro to tempt buyers. It's getting increasingly difficult to launch a smartphone with some standout feature, something *more* than just bigger screens and faster processors.

For the G2, LG's decided to make a major

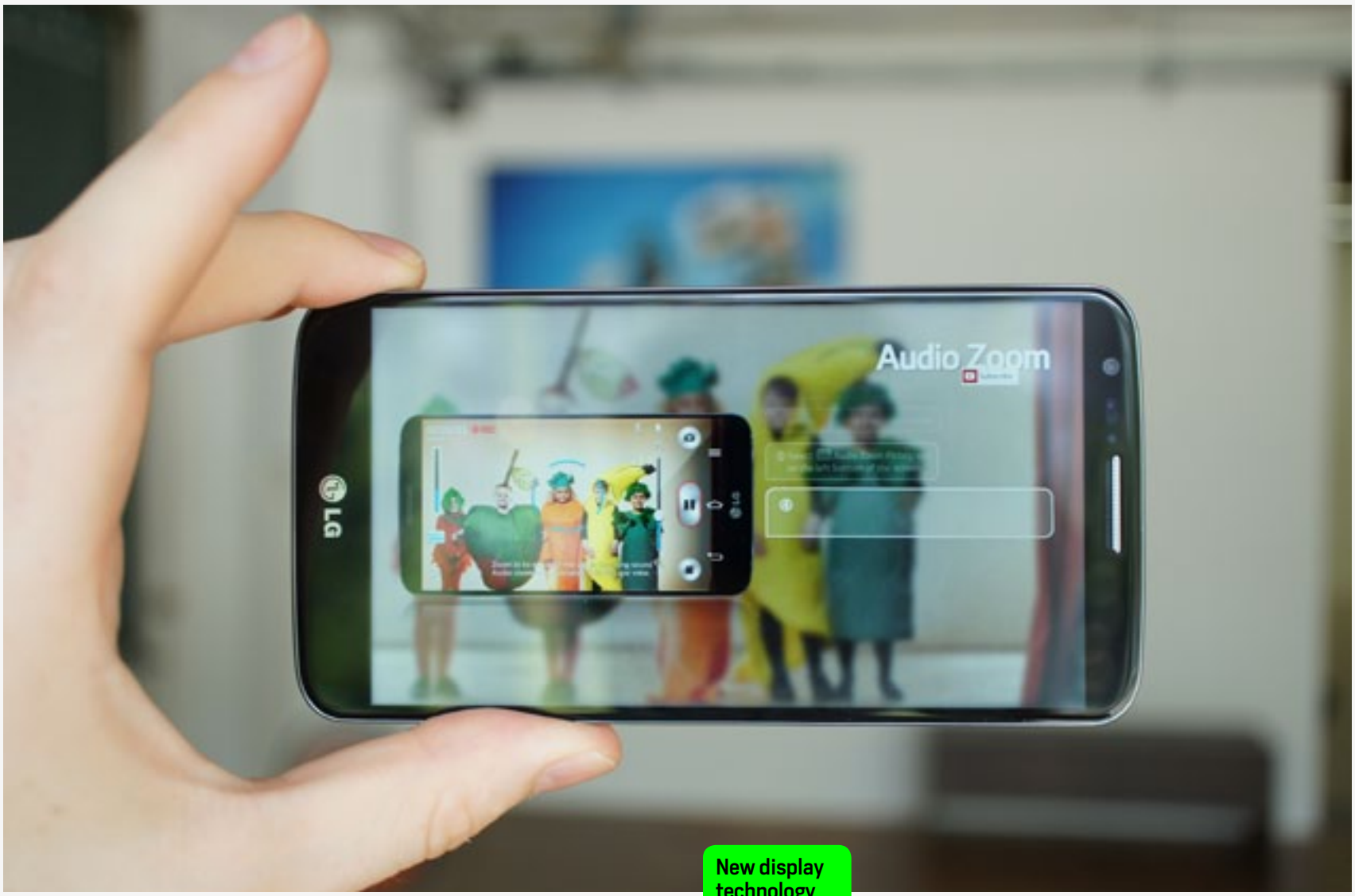
change to the phone's physical layout — in a bullet-point summary, it has buttons on the back. Three, in fact. LG reckons that as the size of smartphones has increased, at this point, the viability of buttons around the edges is now questionable. The new G model lands between last year's Optimus G and the Pro size-wise, breaking through the 5-inch screen barrier with a bright 5.2-inch, 1080p IPS screen. The rest of the feature set will seem familiar to anyone who's read a flagship Android phone review in the last 12 months. Optical image stabilization, remote control blaster, a mixed bag of proprietary software features and Android 4.2.2. There's also some new stuff, including 24-bit / 192kHz audio recording and playback, and it could well be the first Snapdragon 800-powered smartphone to reach US stores — that's Qualcomm's most potent mobile processor yet. But with IFA just finished and the Galaxy Note 3 now official, is a button transplant going to be enough? In fact, that's a red herring, because there's actually a far better reason to buy the G2 — and it's none of the above.

HARDWARE

LG hasn't broken the mold with the G2. It doesn't stop me from whimsically looking back to the HTC One or the iPhone — high-water marks in smartphone design — but it's no eyesore either. From the front, it's like a conceptual sketch of a smartphone made real. What's impressive, though, is how when you switch the G2 on, that front surface just comes to life. LG has squeezed a 5.2-inch screen into a phone with the same footprint as 5-inch devices like the Galaxy S 4. How? With 0.1-inch-thick bezels, made possible by a new display touch sensor using two connectors. Even above and below the screen, there's only 0.4 inch of space before the phone's edges. The lower part has an LG logo and nothing else (Android buttons are of the on-screen variety); above you'll find the loudspeaker, light sensor and front-facing, 2.1-megapixel camera. There's also a satisfying curve to the Gorilla Glass 2 front, similar to what you'll find on the Nexus 4 and recent Lumias. It adds a pinch of class to what is (at least from the front) an otherwise standard-looking handset.

It's when you flip the phone over that we begin to see a bit more flair. Aside from the rear-button trio, there's a glossy, patterned finish to this black model, and while the pattern helps disguise it a little, it loved my fingerprints; completing our typical melee of glamor shots with the G2 bordered on an exercise in futility. I'd advise carrying around a cloth if you're averse to smears.

The lack of a removable battery cover is going to aggravate power users looking to swap out batteries and SD cards, but the payback is in the solid build quality — and also the fact that you get more space for the battery. If I prodded the back with a bit of force, I could see the plastic flex a little, but not enough to detract from the other-



New display technology allows for more screen real estate.

wise sturdy design.

The volume buttons on either side of the primary power nub are covered in a matte, almost gritty finish, which means they stand out from the phone's glossy background and also offer a little bit more grip. The power button is surrounded by an LED outline, but it's not capable of the same fancy light show seen on the Optimus G Pro's power switch. Nope, those tricks are found in the front-facing LED notification light, and you can choose whether that front-facing one will inform you of calendar events, alarms, missed emails, calls or just tell you when the phone's charging. The rear LED will flash for incoming calls and alarms only.

There are no other buttons on the device, which is a little daunting at first. If you've ever moved from a Google device to an iPhone, or simply switched to a different brand within Android, you'll know it takes a while for you to get used to the new button arrangement. With the G2, double that. Then add a day. I had to recalibrate how I held the phone, to ensure my index finger was in the right place — meaning a few inches higher than I normally do. A big deal? No, but it certainly felt slightly more precarious in the hand than usual. LG has made some efforts to reduce the issue: two taps to the screen will wake the G2 up, lessening your need to reach for the power button on the back.

LG went outside the box with their rear-button design.

As I continued to use the G2, however, I became more at ease with the button placement. The raised portion that houses the power button was the most prone to bumps, but it didn't result in any long-term scratches. In fact, I preferred to leave the phone facedown on surfaces and let the Gorilla Glass 2 do its job protecting the G2's beautiful display.

Is a 5.2-inch IPS screen with 1080p resolution the limit of what we can call a smartphone before classifying it as another smart-device bridge between tablets and phones? At the moment, yes. At just less than 5.5 inches tall, it's a tight call. You'd think smaller hands would likely fare better with a 5-inch screen, but the G2's shaved dimensions mean it's really not much different than the Xperia Z (5.47 inches), the GS4 (5.38 inches) or even its predecessor, the Optimus G, which measures 5.2 inches. All told, it's definitely a notch below the likes of the G Pro or Galaxy Note II.

LG's IPS smartphone displays are some of the best in the business. Bright and rich, with great viewing angles, I've got no gripes with them — alongside HTC's Super LCD 3, this is the level I want to see in all future smartphones. This 1080p, 5.2-inch version was suitably bright in harsh sunlight, although the auto brightness setting didn't seem to work at all on this model — something I'm chalking up to this being an early

build. Alongside the IPS display, LG has added in Graphic RAM (GRAM), which adds a memory cache of the screen when static, meaning when the screen isn't changing, the CPU and GPU don't have to communicate, allowing the processor to cool down and saving on battery burn. LG reckons it can reduce the display's energy use by up to 26 percent. We'll see how that fares in the battery test section.

Stepping up to complement the richer visuals, LG's included 24-bit / 192kHz music support —- for recording and listening — on both FLAC and WAV files. Now, you'll have to be using those sorts of files to begin with, but the G2 is the first to support audio at a level above CDs, and for that it should be lauded. However, it's not the earth-shaking feature LG likely wants it to be.

CAMERA

It makes sense for LG to pair a high-pixel-count camera sensor (13 megapixels, no less) and optical image stabilization, as the duo should make for crisper shots with less blur and noise. More pixels mean that your shots should also grab more detail. It appears to be the same setup we tested on the Optimus G Pro, (BSI 13-megapixel sensor, f/2.4 aperture lens, autofocus and LED flash), although LG has gone further with the manual settings you're able to tweak; there's now a manual focus slider to maximize those macro shots, alongside tap-to-focus and face-tracking.

You can also use those rear-facing volume keys not only as a shutter button, but also for zoom. I found the latter was a better option. When trying to use those rear-facing buttons to capture a shot, my fingertips would inadvertently graze the lens slightly because it's simply so close the three-button array. I ended up taking the majority of my sample pics with the on-screen shutter button. Image quality was good, although due to recent developments in rival smartphones' low-light photo skills, I found LG's flagship lagging behind the likes of the HTC One or the recent Lumia models. It's still capable of some great shots, but it was more temperamental, often capturing a lot of noise and artifacts if lighting was less than ideal.

An honorable mention goes to the G2's HDR mode, which (possibly thanks to that high-end Snapdragon 800) seems both more capable and faster to respond than other smartphones we've tested it on. There's less ghosting (one picture's edges not overlapping correctly) and better detail than perhaps you're used to seeing on smartphone HDR shots. We're sure that the optical image stabilization can take some of the credit here. You can also lock exposure and focus -- just touch and hold the shutter button, then release your finger to capture the shot. It's a decent substitute for a proper dual-detent camera button, and a nice touch.

The other modes are a mixed bag. Useful ones include "Shoot and Clear" mode, which removes moving objects from your photos, as well as familiar

The G2 is finicky with its performance in low light.

ones like panorama mode, burst shot and intelligent auto. Then there are the unfortunately redundant modes, like VR panorama, which is just as temperamental here as any on other smartphone that tries its luck with Photo Sphere, and Dual Camera.

The sample videos were largely crisp, but I had some issues with autofocus. While the optical image stabilization stopped any jumpiness inherent with recording on a smartphone, the G2 kept attempting to refocus, even when the subject wasn't moving around. It left us with a video where the smartphone keeps readjusting its focus, adding moments of blur to the clip. Given that LG's offered us an early sample, we'll be testing this again once retail units are available. On the plus side, you can lock focus on something (like someone's face) while capturing video by tapping on it in the viewfinder. There's also a new camera software function for video, Audio Zoom, which uses three built-in stereo mics to amplify sounds in a specific direction. Unfortunately, you have to digitally zoom in, meaning any improvements in audio quality come at the cost of visual performance. One final lovely feature: 1080p 60fps video capture — great for slow-motion playback of action-packed videos.

SOFTWARE

It wouldn't be an Android phone from a Korean manufacturer without some software on the side, right? To start, Google's Android 4.2.2 brings along Google Now and Project Butter smoothness for the ride, but LG's added its own twist, in part to assist with those

rear-facing buttons.

Everything you saw on the Optimus G Pro is here on the G2, like the dual-camera modes to record video from both the front and back lenses, and (more importantly) the QSlide floating mini apps, allowing you to window off some of the core apps (calendar, internet and, er, calculator).

Unfortunately, as we noted in the G Pro review, there's still a severe lack of non-stock apps. We'd have loved to have seen more support for video applications (Netflix, BBC iPlayer), but this is likely an issue of popularity. LG needs to be a bigger deal before it can get the sort of support Samsung enjoys for its split-screen multitasking features. On the bright side, it's great to see that LG's keeping the IR blaster in its smartphones — I'm hoping the trend continues and rids us of remotes forever.

Moving on to the phone's unusual button placement, you can double-tap the screen to wake it up (as on Nokia's recent phones). You can also do the same on the status bar, empty home screen space or the lock screen to return it to slumber. Suffice to say, it's a lot less awkward than proclaiming "Hey Google Now." LG's previously dense drop-down menu is now even busier. Well, until you start switching off some of the sub-menus. There are dedicated rails for those QSlide window apps and remote functionality —

and those can be turned off, but there are also sliders for brightness and volume, choking the space available on the drop-down for missed calls, emails, reminders and the rest.

One clever addition to LG's latest interpretation of Android 4.2 is the ability to choose which on-screen soft-keys you want, with several permutations of home, back, menu, search, multitask and a shortcut key to the G2's note-taking function available. Swipe around on the Android home screen enough and you'll arrive at a tutorial for some of the phone's newer features. (Don't worry, you can turn this off once you're educated.) Up first is guest mode, which lets you lock down the device so it's kid-friendly or at least protected against pranks and / or corporate espionage. The mode can be switched on through the settings menu, where you can define a specific lock pattern for guest users. You can specify which apps they can access, however Google programs will still think the guests are using your account, so it's worth bearing in mind — it will still hold onto your internet cookies and passwords.

Another multitasking function alongside the QSlide apps is Slide Aside, which will keep three apps running concurrently on the side (you house them there through a three-finger swipe). I'm not exactly sure how much time this saves me over holding the home button (and seeing all the currently running apps), or from simply loading apps again from the home screen. After trying it out once, I never went back to it. It's the new Dual Camera.

PERFORMANCE AND BATTERY LIFE

The G2 houses 2GB of RAM, Qualcomm's 2.26GHz quad-core Snapdragon 800 processor and 16GB of non-expandable storage. In short, it's a beast. Like we mentioned in our Xperia Z Ultra review (packing the same processor), it uses the improved Adreno 330 graphics processor, meaning slicker existing games and (hopefully) richer titles in the future, if Android continues to push the gaming envelope. The Snapdragon 600 didn't exactly crawl along, so it's harder to rave about how smooth everything runs, or how fast apps appear or the phone reboots. Be assured that's all true, and when I fired up the GPU-straining likes of *GTA3*, I was amazed how quickly it loaded right into the game. The benchmark numbers back up my experience — and then some.

The G2 more than doubles the scores we saw on last year's Optimus G. Which is great, but like a lot of Android

Perhaps this is a sign that we're finally crossing into a world of sensible smartphone batteries.

BENCHMARKS	LG G2	SONY XPERIA Z ULTRA	OPTIMUS G
QUADRANT 2.0	**19,138**	18,966	7,513
VELLAMO 2.0	2,895	**2,957**	2,143
ANTUTU 3.2	**31,944**	29,377	11,284
SUNSPIDER 1.0 (MS)	880	**431**	1,283
GLBENCHMARK T-REX 2.7 HD OFFSCREEN (FPS)	20	**23**	N/A
CF-BENCH	**37,120**	31,702	14,372

SUNSPIDER: LOWER SCORES ARE BETTER

phones since 2012, it translates into diminishing returns in real-world use. The new LG flagship doesn't feel twice as fast, but this is the swiftest Android phone we've seen yet, even despite all the extras LG's attached to the stock Android software. The G2 is LTE-ready, and it's coming to all the major US carriers, so your requisite bands are covered. However, I couldn't put those to the test — so we'll update when we can. On a 3G SIM, however, my HSPA+ data rates were around 2.2 Mbps down, and 400 Kbps up — pretty much standard across the networks. Voice calls were also clear, with a trio of mics helping to cancel out unwanted noise.

When it came to battery life, I had high hopes and during the first few days of testing, those hopes were fulfilled. Now, a 3,000mAh battery might not sound like a lot (especially with a high-end processor and large 1080p screen ticking along). It's smaller than both the Galaxy Note II (3,100mAh) and the Droid Maxx (3,500mAh). But, rejoice, because those flagship specs can go along with top-class battery life. Under heavy use, I was easily able to cross over the 20-hour mark, with regular use of GPS, WiFi and voice calls, all with the screen on at least half-brightness. Less holistically, in Engadget's HD video rundown, I managed a glorious (well, tortuous if you're in the middle of reviewing) 16 hours of playback on a single charge. Alongside the Moto X, perhaps this is a sign that we're *finally* crossing into a world of sensible smartphone batteries.

WRAP-UP

The G2 took what I loved from the tablet-smartphone category, and crammed it into a regular smartphone. A big one, granted, but not an unnecessarily huge one. LG's smartphone screens are among the best, and its newest

phone continues to lead its peers. This time around, however, it's got the battery to do it justice. I had no aversion to watching more video, taking more photos or just doing more with the G2 because I knew that the phone would go the distance even with very heavy use. Incredibly, too, the device isn't even being marketed for its battery savings so much as its top-notch specs. Here, then, you can finally have the best of both. If you're sick of phones that won't last until sunset — I'm looking at you, Nexus 4 — this is the solution.

The new button positions are not a gimmick, but they take some getting used to and indeed, many prospective users might never come around. After a week of using the G2, I'm utterly sold on the double-tap to unlock. There was no need to reach around for the power switch; I just had to be able to reach the screen to check emails or the time. There are some new duds in LG's new software coffers (Slide Aside can be left aside), and the OS feels denser and more complicated than a vanilla Android build, but there are still a few gems to ensure LG's skin is worth using. With that battery life, Google and LG could oblige us with a Play version, or maybe we'll see specs crammed into the next Nexus — we certainly liked the price tag the last time that happened. The miraculous endurance of the G2 paired with a high-level screen and processor, make it one of the most tempting smartphones I've seen in the last six months. D

Edgar Alvarez contributed to this review.

Mat is an Associate European Editor who lives in the UK. He's a Liverpool supporter who enjoys obscure Japanese game shows.

BOTTOMLINE

LG G2

$200 (ON CONTRACT)

PROS

- Amazing battery life
- Bright, expansive 1080p screen
- It has buttons on the back

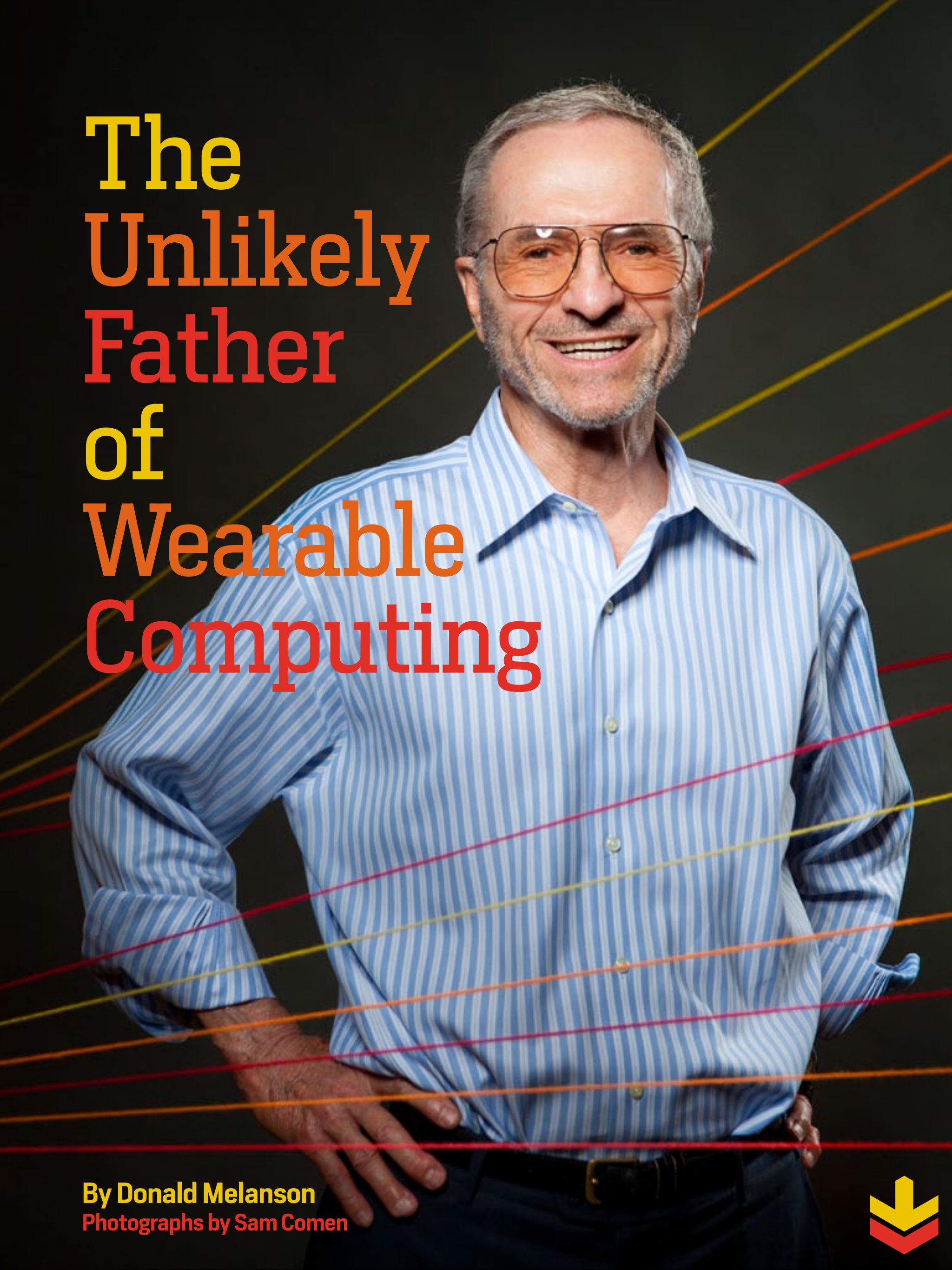
CONS

- Inconsistent camera
- Redundant software additions
- It has buttons on the back

BOTTOMLINE

A combination of high-level specifications and great battery life make the G2 one of the best flagship Android phones out there. However, those rear-facing buttons won't be for everyone.

The Unlikely Father of Wearable Computing



By Donald Melanson

Photographs by Sam Comen

"My name is Edward Thorp."

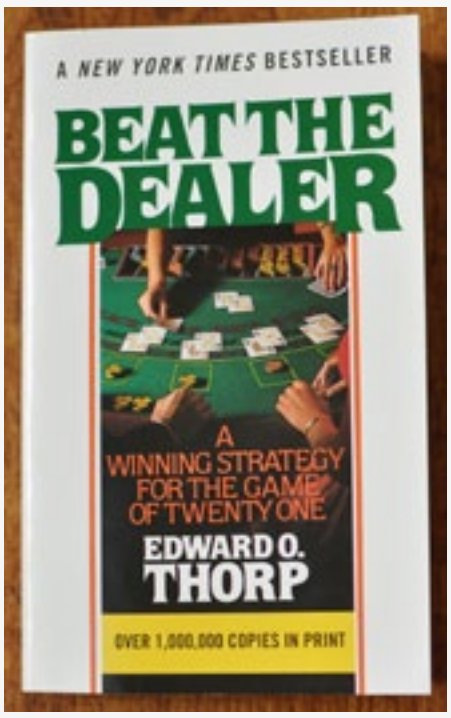
"My name is Edward Thorp."

"*My* name is Edward Thorp."

IT'S 1964 and Edward Thorp is on the television game show *To Tell The Truth*, sitting alongside two other well-dressed men also claiming to be Edward Thorp, a man so adept at card counting that he'd been barred from Las Vegas casinos. Thorp, the quiet man on the right, every bit the mathematics professor with black-rimmed glasses and close-cropped hair, is the real deal.

Two years earlier, Thorp's book, *Beat the Dealer,* was published, explaining the system for winning at blackjack he developed based on the mathematical theory of probability. The system worked so well that Las Vegas casinos actually changed the rules of blackjack to give the dealer an added advantage. Those changes would prove to be short-lived, but Thorp's book would go on to become a massive bestseller, and remains a key guide to the game of blackjack to this day.

That all this happened as the computer age was flourishing in the 1960s isn't coincidental. While working to beat the house, Thorp was also working at one of the hotbeds of that revolution: the Massachusetts Institute of Technology. There, he had access to two things that would prove invaluable to his research. One was the room-filling



Thorp's hugely successful book that, according to *To Tell The Truth*, was once the most requested book at the Las Vegas library.

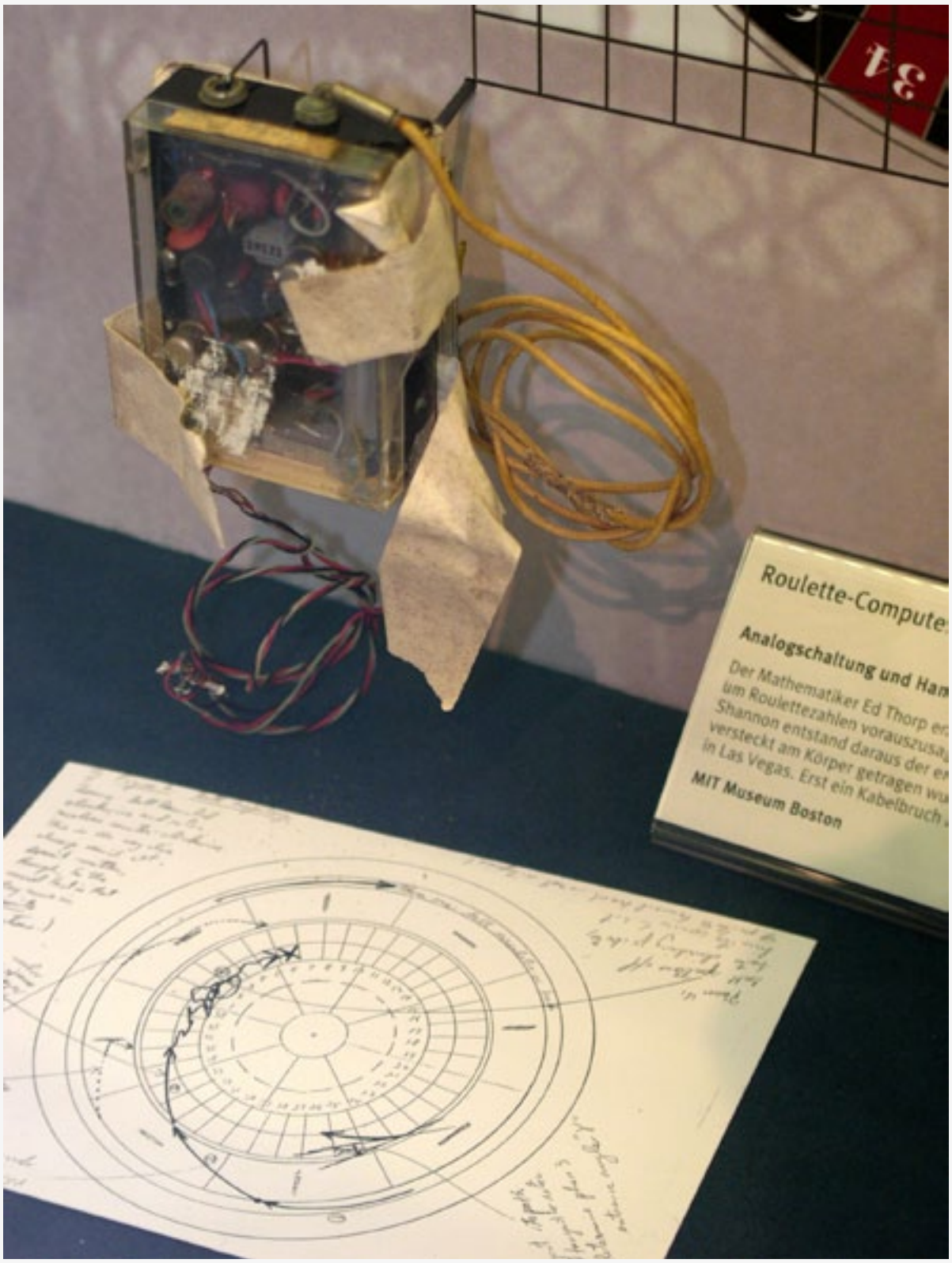
IBM 704 computer, without which, he writes in *Beat the Dealer*, "the analysis on which this book is based would have been impossible."

The other was MIT professor Claude Shannon, who worked on cryptography and code-breaking during World War II, and would go on to become known as the father of information theory — and, indeed, the information age. It's with Shannon that Thorp would revisit a question he had considered years earlier: whether he could apply mathematics to beat the game of roulette as he had done with blackjack. Thorp and Shannon would develop a friendship and, in the process of answering that question, build what is widely regarded to be the first wearable computer.

It's a device that's decidedly simple by today's definition of a computer; one designed for a single task — beating roulette — as opposed to a more general-purpose machine. It was also a homebrew project in the truest sense, looking like not much more than a small box stuffed with wires and electronics. Input and output were handled with the tap of a shoe and an audible tone in an earpiece, with the computer itself simply strapped around the waist. Then again, when you're trying to sneak a computer into a Vegas casino, one of your primary concerns is not being seen.

A proto-Google Glass it was not, in either form or function, but it would be some time before we'd see anything else resembling a wearable computer.

DONALD MELANSON



This main unit would be worn with one wire running into the shoe to track timing of the roulette wheel, while another would run up to an earpiece for receiving the audio-based results.

COURTESY OF EDWARD THORP

A proto-Google Glass it was not, in either form or function, but it would be some time before we'd see anything else resembling a wearable computer. It nonetheless offered an early hint at the more complex wearable devices that would follow decades later — from the pioneering work of Steve Mann and others in the 1980s and '90s, to today's smartwatches and activity trackers. And it's due in part to those devices that Thorp's wearable computer is remembered more now than ever before.

Thorp first revealed the computer and his ability to successfully predict roulette with it in the second edition of *Beat the Dealer*, published in 1966, although he only described it in broad terms. In it, Thorp wrote that he "played roulette on a regulation wheel in the basement lab of a world-famous scientist," and that "in an hour's run, betting no more than $25 per number, we won a fictional $8,000!" Thorp also noted that "there are certain electronic problems which have so far kept the method from being used on a large scale in the casinos."

Thorp would later explain the system in detail in a paper titled "The Invention of the First Wearable Computer,"

published in 1998. Like *Beat the Dealer*, it isn't quite the dry document you might expect, interspersing personal anecdotes with technical details. That "world-famous scientist" was, of course, Shannon, who Thorp first visited in November of 1960 to see about getting his blackjack paper published. After a short meeting, Shannon agreed to help Thorp with his paper, and asked him if he was working on anything else in the gambling area. Thorp wrote that he "decided to spill my other big secret," and the two then spent "several exciting hours" talking about his plan to beat roulette. The germ of the idea for a wearable computer was planted in Thorp long before he walked into Shannon's office, however.

Early Experiments

Speaking on the phone from his office in Newport Beach, Calif., Thorp, now 81, recalls an ingenious scheme for a wearable computer of sorts that he dreamed up at the age of 13 — when, incidentally, he was already a licensed ham radio operator. After realizing the scalp could conduct electricity, his plan was to shave his head, put electrodes on it and rig a door with a motor and receiver so he could open and close it just by thinking. He says he had lots of other projects going on, though, "as ever," and never got around to carrying through on the plan.

Two years after that initial idea, the topic of roulette came up when a favorite high school teacher of his was talking about a recent trip to Vegas. The teacher was telling Thorp that you couldn't beat the casinos, and Thorp recalls telling him that he thought he could, and that he would try it. "I was extremely interested in all things scientific," Thorp says, "and I was a builder of devices and gadgets." The notion the young Thorp had was that the orbiting ball of a roulette wheel reminded him of a planetary system, or of a pendulum that's gradually dissipating energy. Thorp says that idea "sort of lodged in my head," and it would resurface while he was at UCLA getting his master's in physics in 1955.

While talking with fellow students that year, Thorp

Using the roulette computer was actually a two-man job. One person would wear the device and time the wheel, while the other would sit at the table with a receiver, hearing the results as various audio tones.

COURTESY OF EDWARD THORP

recalls the topic of beating the casinos came up again, and he laid out his plan for a computer that could be used to win at roulette. The other students remained skeptical, but Thorp decided then to work on it. He began some tests, and eventually made his way to experiments using a half-size roulette wheel before taking a trip to study full-size casino wheels in action.

By then, Thorp was also well-acquainted with computers. "I sort of got into them early," he says. One of his jobs as a physics graduate student at UCLA was working on the computer they had at the Institute for Numerical Analysis, and he had also worked on a room-filling differential analyzer, an analog computer with gears and shafts originated by Vannevar Bush, on which he would literally crank in data.

When he got to MIT, he would also have access to the IBM 704, which was on the leading edge at the time, but

it was still a somewhat slow process. “I would type stuff on punch cards and wrap it up in a rubber band and turn it in,” he recalls, “and then a couple of days later I’d get a piece of paper back, and my punch cards, and it’d tell me what happened. And I would move on to the next phase of the calculation.”

As he made his way from UCLA to MIT, however, Thorp’s interest shifted from roulette to blackjack, and he set the wearable computer project aside until his meeting with Shannon.

The Plan Comes Together

After their initial meeting, Thorp says, “we got right to it,” and he spent about half his time for the next eight months working away with Shannon in that basement lab in his house, on one of Massachusetts’ Mystic Lakes. In his paper, Thorp described the lab as a “gadgeteer’s paradise,” with what he estimated to be about a hundred thousand dollars’ worth of electronic, electrical and mechanical items. The regulation roulette wheel, ordered from Reno for $1,500, was set up on an old slate billiard table.

Thorp describes Shannon as the “ultimate gadgeteer,” and recalled in his paper that the man he met in that office was a “thinnish alert man of middle height and build, somewhat sharp-featured,” and that “his eyes had a genial crinkle and the brows suggested puckish incisive humor.” That humor would become evident as the two worked together at the house on the lake. Thorp wrote that Shannon taught him to juggle three balls, and that he rode a unicycle on a steel cable strung between two tree stumps. “He later reached his goal,” he wrote, “which was to juggle the balls while riding the unicycle on the tightrope.”

Thorp also recalled a contraption of Shannon’s that would have no doubt thrilled his 13-year-old self. “As a joke,” he wrote, “he built a mechanical finger in the kitchen, which was connected to the basement lab. A pull on the cable curled the finger in a summons.”

After months of experiments, the two settled on a computer they thought would work. Roughly the size of a pack

During their tests, Thorp and Shannon found that the computer gave the wearer a 44 percent edge in roulette — more than enough to make it worth their while.

of cigarettes, the computer itself had 12 transistors that allowed its wearer to time the revolutions of the ball on a roulette wheel and determine where it would end up. Wires led down from the computer to switches in the toes of each shoe, which let the wearer covertly start timing the ball as it passed a reference mark. Another set of wires led up to an earpiece that provided audible output in the form of musical cues — eight different tones represented octants on the roulette wheel. When everything was in sync, the last tone heard indicated where the person at the table should place their bet. Some of the parts, Thorp says, were cobbled together from the types of transmitters and receivers used for model airplanes.

During their tests, Thorp and Shannon found that the computer gave the wearer a 44 percent edge in roulette — more than enough to make it worth their while. By then, it was the summer of 1961, and the two decided it was time to test the computer in a casino. In August, they went to Vegas for a week — Shannon's wife, Betty, and Thorp's wife, Vivian, joined them.

While only one person wore the computer, the operation in the casino was a two-man job. The person wearing the computer would stand by the roulette wheel and time

— also writing down the numbers on a pad to appear like a system player, what Thorp describes as a "decoy mode," since "whoever was doing that was considered harmless because fools do that all the time to no avail."

The other person, usually Thorp, would sit at the betting table with the earpiece and a receiver, hearing the same cues that the person wearing the computer heard. "When the computer was operating without any trouble," Thorp says, "it worked really well." Indeed, it worked just as well as it did in the lab. "We'd start out with dime chips," he says, "and single dimes would turn into piles of dimes, quite often causing a fair amount of excitement, but nobody caught on to what was going on."

"Our problem was output."

Wearing a computer in 1961 wasn't easy. While the small computer worn around the waist was inconspicuous enough, the earpieces proved more difficult. For those, Thorp and Shannon used thin stainless steel wires that were soldered onto the speaker and painted a flesh color. The wires ran down the neck and through the wearer's clothing to the receiver. They proved to be discreet, but the wires were delicate and tended to break, which Thorp says "was the Achilles' heel of the system."

"Once a lady next to me looked over in horror. I left the table quickly and discovered the speaker peering from my ear canal like an alien insect."

After years of using his skills to "Beat the Dealer," Thorp moved on to bigger fish: Wall Street.

"So," he says, "we'd bet for a while and then a wire would break, and we had to go back to the room and take the person who was doing the betting, namely me, apart and solder things together and hook me back up." In his paper, he recounted one incident in particular: "Once a lady next to me looked over in horror. I left the table quickly and discovered the speaker peering from my ear canal like an alien insect."

While those problems prevented them from any "serious betting," they deemed the computer a success. It now resides at the MIT Museum in Cambridge, Mass.

Although most would consider Thorp and Shannon's invention to technically be the first wearable computer,

it's not quite a wearable computer as we know them today. For the origins of more general-purpose wearables, we need to look a few decades later to the work of Mann, who also, as it happens, found his way to MIT. He'd be joined there by Thad Starner and others, with their pioneering efforts in the 1990s laying much of the groundwork for Google Glass and today's other wearable devices.

That's not to say Thorp and Shannon's work didn't inform those later devices in some respects, though. In an article published in *IEEE Micro* in 2001, Starner cited Thorp's computer as an example of a device where "unobtrusiveness and privacy were primary concerns," explaining that "not only was it necessary to keep private the information generated by the wearable," but also that "Thorpe and Shannon needed to hide the computer's existence from onlookers." Those concerns brought with them the type of trade-offs that continue to be an issue today — in this case, an awkward interface and other physical limitations in the pursuit of portability and discretion.

In a broader sense, the computer was also an "augmentation" of sorts, giving its wearer the ability to keep track of more information than they would be able to otherwise — something that's now becoming more prevalent than ever thanks to the likes of wrist-worn activity trackers — and access to information that others don't have.

While Thorp wouldn't go on to develop the sort of general-purpose wearable computers that Mann and Starner eventually would, he did build a second wearable device soon after the roulette computer. Described as a "knock-off," it was designed to beat the money wheel, or wheel of fortune. It had just a single transistor and could be operated by one person on their own, but Thorp says that the wheel itself didn't get much action and that anyone winning a lot of money would attract a lot of attention. "So it was something that would work in principle," he says, "but you couldn't actually make any money at it."

Thorp and Shannon also considered building a computer for blackjack, but Thorp says he could already count so well that it didn't seem worth the effort. He also specu-

"The descendants of the first wearable computer were formidable enough to be outlawed," Thorp wrote.

lated about a different type of system in *Beat the Dealer*, suggesting that it would be "technically feasible to link a casino blackjack player by radio to a remotely located giant machine, which does the actual playing."

Another well-known blackjack player, Keith Taft, would actually go into the business of building and marketing blackjack computers much later. In the late 1970s, a group of students at the University of California, Santa Cruz, who called themselves "The Eudaemons," also built a computer to win at roulette, this time with the computer itself contained in a shoe. By 1985, though, Nevada would ban the use of devices designed to aid in card counting or predicting the outcome of other games. "The descendants of the first wearable computer were formidable enough to be outlawed," Thorp wrote.

By then, however, Thorp had already moved on to a much bigger arena: Wall Street. He was one of the original "quants," applying mathematics and computers to the stock market, and making a fortune at it. His book on the subject, *Beat the Market*, has become a guide for countless investors as *Beat the Dealer* has been for blackjack players. That also explains his diminished interest in gambling over the years. "When you're betting millions," he says, "betting hundreds of thousands doesn't seem meaningful."

A Restless Retirement

At 81, Thorp is still looking for new projects to take on. One of his current interests is biotech, and new research

in low-temperature medicine that promises to let corneas be vitrified and stored for long periods of time ahead of a transplant, instead of being discarded after a few days. Another development he has his eye on could allow for brains to be cooled much more rapidly for surgical purposes. As with the rest of our conversation, it's a topic he discusses in exacting detail.

It comes as no surprise, then, to hear that he's not the retiring type. "There's so many interesting things all the time," he says. "That's the problem.

"I think of the classical retirement as kind of crazy, where you're 65, you throw a switch, and stop doing anything," Thorp says. "To me, retirement is a transition from whatever you were doing to whatever you want to do, at whatever rate you want to make the transition."

As with gambling, computers have also been far from Thorp's main focus in more recent years. He never really considered a career in the field, he says, since for him "they were more tools than things unto themselves." And, while he's remained interested in computers, he hasn't followed the evolution of wearable computing particularly closely.

He is somewhat familiar with Google Glass, however, and he does see his invention as a precursor of sorts to it and other wearable computers. "It's sort of an interesting contrast," he says, "when you think back to this little box … and then you jump 50-plus years ahead and now you have Google Glass, with all its manifold capabilities. It's startling to see how much has happened in a little over 50 years."

As for his place in that evolution, while he by no means needed another legacy, Thorp is now often called the "father of wearable computing." That's hardly a title he set out to claim, though. "I didn't realize at the time that that was going to happen," he says, "I was just interested in solving a problem and seeing if I could do it. The fact that it was a wearable computer was just part of solving the problem." D

Don Melanson is a Senior Associate Editor at Engadget, a denizen of Canada's east coast, and generally curious.

ESC

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DISTRO
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KIROBO

See it in action!

TOYOTA

ESC

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KIROBO

See it in action!

The Kibo Robot Project is a joint-research endeavor from Japan that aims to bring man and machine closer together with a little friendly conversation. Kirobo, the project's robot ambassador and astronaut broke its silence on August 21st after nearly three weeks aboard the ISS and wished a "good morning to everyone on Earth," making it the first (real) robot to speak in outer space. Astronaut Koichi Wakata will join Kirobo aboard the ISS later this year to explore human / robot interactive conversation backed by the robot's voice-recognition and natural-language processing skills. And hopefully, make some inroads before the whole robopocalypse thing goes down.

TOYOTA

PHIL NICKINSON

The ANDROID CENTRAL EDITOR on technological milestones and clever codenames

What gadget do you depend on most?
Smartphone, for sure. Keeps me in contact with everyone at work, and everyone at home when I'm away working.

Which do you look back upon most fondly?
The Treo 750 — my first smartphone and the one that ultimately led me to this job.

Which company does the most to push the industry?
Probably Google (and Apple, though not quite as much lately) because of services. Google really

ushered in the cloud for normal folks. Apple changed the world with iTunes. Maybe toss Skype in there for consumer-friendly VoIP.

What is your operating system of choice?
I was a Windows guy for years, but hopped over to OS X a couple years ago. Android for mobile, natch.

"I still remember the Apple //e being rolled into my kindergarten class. Couldn't take my eyes off it."

What are your favorite gadget names?
The internal codenamed ones used by HTC and Sony often end up being better than the release names. (Especially when the US carriers get involved.)

What are your least favorite?
Anything thought up by BlackBerry. Too many numbers. ASUS has done its part to add to the confusion as well (even if the products are great).

Which app do you depend on most?
Gmail. Always Gmail. (And then TripIt for keeping all my travel straight.)

What traits do you most deplore in a smartphone?
Half-assed cameras. It's inexcusable. It's not really the phone's fault, but the way we buy phones in the US is beyond broken. If you're theoretically going to use something that much over two years, you need to buy something good. Not something free.

Which do you most admire?
When manufacturers add features without getting in the way of the overall experience. That's not easy to do, either.

What is your idea of the perfect device?
Something short of five inches, with curves in all the right places. Doesn't have to run "all day," but 12 to 15 hours is about right. Has to have a camera that doesn't make me wonder if I should be carrying a second device. Running Android, of course.

What is your earliest gadget memory?
I still remember the Apple //e being rolled into my kindergarten class. Couldn't take my eyes off it.

“Moto X needs a better camera. HTC One needed better manufacturing, QA and a lighter touch on software.”

What technological advancement do you most admire?
Fire, then the wheel, then electricity. Skip ahead to the internet, I reckon. Maybe add booze into that timeline somewhere, too.

Which do you most despise?
Anonymous comments.

What fault are you most tolerant of in a gadget?
Little design flaws. Parts that don’t quite fit as well as they should because of the manufacturing process.

Which are you most intolerant of?
Bad cameras, poor battery life, unusable displays.

When has your smartphone been of the most help?
It became ever more important after I had kids. Helps me feel a little closer (yet simultaneously farther away) when I’m on the road. Oh, and it lets me do work and get paid, too. That’s also important.

What device do you covet most?
Is a Tesla Model S a device?

If you could change one thing about your phone what would it be?
Depends on the phone, of course. Moto X needs a better camera. HTC One needed better manufacturing, QA and a lighter touch on software.

What does being connected mean to you?
Back to the family thing. I can be on the other side of the world and see my wife and kids, even if but for a few minutes.

When are you least likely to reply to an email?
Either right away, or maybe not at all. I’m really inconsistent about that.

When did you last disconnect?
The nine-hour flight last week from Paris to Atlanta. D

IN REAL LIFE is an ongoing feature where we talk about the gadgets, apps and toys we're using in real life.

MAD CATZ RAT M GAMING MOUSE

NESTLED IN MY TRAVEL BAG, alongside my headphones, FreedomPop MiFi and a Nintendo 3DS, is a tiny pocket containing a $10 travel mouse I picked up at Target. It's terrible, uncomfortable and far too imprecise to handle much more than very basic web browsing. Normally, this isn't much of a problem, since most PCs come with workable mousing tools built in, but as a PC gamer, there are times when I need something *better*. Lately, that's been Mad Catz's Rat M, a mobile version of its popular Rat 9 gaming mouse.

Visually, the M is simply a scaled-down clone of the 9, but close inspection reveals it's actually missing some functionality, too. The M, for instance, has only a single button below its scroll wheel, as opposed to the Rat 9's rocker, and it completely abandons the horizontal scroll wheel used on the original. The mouse also forgoes a few of its big brother's transforming features, including the ability to adjust weight and thumb rest positions. Still, it's a versatile little rodent, with an extending palm rest, six traditional buttons and a four-direction thumb rocker that pulls double duty as the mouse's seventh button. Best of all, its belly houses a 6,400-dpi sensor, offering more than enough sensitivity to handle fast-paced gameplay.

The Rat M is comfortable, sensitive and well-equipped, but it does still have some drawbacks. Mad Catz lists the mouse's Bluetooth 4.0 Low Energy compatibility as a selling point, but it's hard to get the mouse to connect without using the included USB dongle. Worse, when you *do* get a Bluetooth connection running, the mouse often lags and jumps around the screen. It also has the unfortunate status of being the only device in my travel bag that requires AAA batteries. Blegh. Still, as long as you stick to the USB dongle, it's a handy little gaming mouse. It is a bit expensive, though — $115 is a lot to ask for a mouse you'll only be using on the road. — *Sean Buckley*

The week that was in 140 characters or less

Androids Exhale, Hands Quiver and Mario Moves Out?

@peterrojas
Hmm, $549 for unsubsidized iPhone 5C is more than I was expecting. I bet there are some Android OEMs breathing a sigh of relief right now.

@Tim_Stevens

Just occurred to me that in Russian 'C' is pronounced 'S.' That's going to make ordering your new iPhone in Russia a bit challenging.

@garywhitta

"Don't be PLAGUED by inferior cellphone service!" – if @ATT had been around during the Black Death. #ATTtragedies

@PhoenixRises69
iPhone 5s fitted with fingerprint recognition. I'll sleep easier knowing that if my phone gets stolen, they'll likely chop off my hand too.

@sean_cooper
I'd love it if Nintendo tanked so Mario could get onto a proper console.

THE STRIP | BY SEAN PRIOR

WHAT IS THIS?

TOUCH TO FIND OUT

BONHAMS

LANCASTER WATCH CAMERA

Avid photogs, Instagram addicts and even your modern spy don't have to look much further than the average smartphone for capturing quick pics with an unobtrusive shooter. In the late 1800s, however, it took some creativity to miniaturize and obfuscate a camera. J. Lancaster & Son, a British photographic company, created this early edition Watch Camera that wedged a spring-loaded telescopic lens, shutter and photo plate holder into a nickel-plated pocket watch case. Sensitized single-exposure plates could be secured behind a rear panel allowing for inconspicuous snapshots on the go. Improved versions of this device quickly rendered it obsolete, making this a unique example of (spy?) photography's beginnings and a valuable bit of kit. So much so that this secretive shooter fetched about $34,000 at Bonhams' auction house in 2007.

MODERN EQUIVALENT:

Samsung Galaxy Gear

BONHAMS

iPad

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